

REMARKS

The Office Action dated December 19, 2002 has been reviewed in detail and the application has been amended in the sincere effort to place the same in condition for allowance. Reconsideration of the application and allowance in its amended form are requested based on the following remarks.

Applicants retain the right to pursue broader claims under U.S.C.

§ 120.

Applicants have provided a unique solution with respect to A FLAT PANEL LIQUID-CRYSTAL DISPLAY SUCH AS FOR A LAPTOP.

Applicants' solution is claimed in a manner that satisfies the requirements of 35 U.S.C. §103.

Specifically, Claims 14-16, 18-19, 21-33 have been canceled and Claims 34-51 are newly presented herein. Care has been taken to avoid the introduction of new matter. All of the changes made in this Amendment are without prejudice, so that the matter deleted maybe reintroduced as necessary for prosecution of the application.

Please note that for all of the arguments presented herein, the symbol "%" when used in reference to the composition of glass refers to the amount of a particular component in percent by weight based on oxide.

1. Rejection Of Claims 17-29 Under 35 U.S.C. §103 In View Of

Narita

Claims 17-29 were rejected under 35 U.S.C. 103(a) as being unpatentable over Narita (US 6,468,933), Narita herein

1a. Rejection Of Examined Claim 20 In View of Narita

The Examiner stated:

"Narita et al. teach an alkali-free glass consisting of 40-70 wt% SiO₂, 5-20 wt% B₂O₃, 6-25 wt% Al₂O₃, 0-10 wt% MgO, 0-15 wt% CaO, 0-10 wt% SrO, 0-30 wt% BaO, 0-10 wt% ZnO, 0.05-2 wt% SnO₂, and 0.005-2 wt% Cl₂. See abstract of Narita et al. Narita et al. teach that glass can be used as a substrate for display technologies. See column 1, lines 7-10. Narita et al. teach that it is preferable not to use Sb₂O₃ and As₂O₃ as fining agents due to toxicity. See column 3, lines 46-47. Narita et al. teach that the glass is free from bubbles that result in display defects. See column 1, lines 49-52. The reference teaches that the glass can be formed by various methods including the downdraw process and the float process. See column 4, lines 11-14.

Narita et al. differ from the instant claims by not teaching specific examples that lie within the compositional ranges nor ranges of glass components which are sufficiently specific to anticipate the claim limitations. However, the compositional ranges of Narita et al. overlap the compositional ranges of claims 17-29. Overlapping ranges have been held to establish *prima facie* obviousness. See MPEP 2144.05.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected from the overlapping portion of the ranges of Narita et al. because overlapping ranges have been held to establish *prima facie* obviousness.

One of ordinary skill in the art would expect that glasses with overlapping compositional ranges would have overlapping ranges of properties as recited in claims 17-21, 28, and 29."

1b. Discussion Of Rejection Of Examined Claim 20 In View Of Narita

With reference to the Abstract, the cited Narita reference discloses:

"an alkali-free glass consisting of
40-70 wt% SiO₂,
5-20 wt% B₂O₃,
6-25 wt% Al₂O₃,
0-10 wt% MgO,

0-15 wt% CaO,
0-10 wt% SrO,
0-30 wt% BaO,
0-10 wt% ZnO,
0.05-2 wt% SnO₂, and
0.005-2 wt% Cl₂.["] (emphasis added)

It is submitted that the Narita reference discloses very large ranges for eight of the components of the borosilicate glass.

It is submitted that the very broad ranges of Narita for the mentioned eight glass components cover a great number of different types of borosilicate glass, as will be explained in greater detail below.

As understood, there is no disclosure in Narita of a glass transition temperature, T_g. There is also no disclosure in Narita of a relationship between the glass transition temperature, T_g, on the one hand and both, a melting temperature at a viscosity of 10² dPas and a hot shaping or hot forming temperature at a viscosity of 10⁴ dPas, on the other hand.

It is further respectfully submitted that the broad ranges for the mentioned eight glass components of Narita do not provide "sufficient specificity" as required by MPEP 2131.03. MPEP 2131.03 states, in part:

"When the prior art discloses a range which touches, overlaps—or is within the claimed range, but no specific examples falling within the claimed range are disclosed, a case by case determination must be made as to anticipation. In order to anticipate the claims, the claimed subject matter must be disclosed in the reference with "sufficient specificity to constitute an anticipation under the statute." What constitutes a "sufficient specificity" is fact dependent. If the claims are directed to a narrow range, the reference teaches a broad range, and

ther is evidence of unexpected results within the claimed narrow range, depending on the other facts of the case, it may be reasonable to conclude that the narrow range is not disclosed with "sufficient specificity" to constitute an anticipation of the claims. The unexpected results may also render the claims unobvious. The question of "sufficient specificity" is similar to that of "clearly envisaging" a species from a generic teaching." (emphasis added)

With reference to the above bolded portion of MPEP 2131.03, please note that, in the present application, independent Claims 17 and 20 each set forth relatively narrow ranges in comparison to the broad ranges disclosed in Narita.

In addition, the claimed ranges of the present invention have been found to produce "unexpected results." In the present invention, the composition produces a glass having a very high glass transition temperature, T_g , that is greater than 700 degrees Celsius. As is known in the art, when the transition temperature is increased, a person skilled in the art would expect an increase in the temperature at which workability is reached and the temperature at which melting is achieved. However, the claimed composition produced a glass where the working points and melting points did not increase as a person skilled in the art would expect. This concept is discussed in much greater depth below.

Therefore, since the "claims are directed to a narrow range, the reference teaches a broad range and there is evidence of unexpected results within the claimed narrow range ... it may be reasonable to conclude that the narrow range is not disclosed with 'sufficient specificity' to constitute an anticipation of the claims," as stated in MPEP 2131.03.

1c. Discussion Of Probabilities Of Selecting Ranges Of Claim 20
From Broad Ranges Of Narita Reference

It is also believed that the Narita reference is insufficiently specific because of the size of the broad ranges disclosed in comparison to the relatively narrow ranges recited in the independent claims of the present invention. These broad ranges are not believed to permit a person of ordinary skill in the art to "clearly envisage" the claimed invention. In this regard, Applicant wishes to discuss herein below what is understood by the Applicant to be the probability of a chance selection of all of the preferred ranges as claimed in Claim 20 using the broad ranges disclosed in Narita as a basis.

1c. (A) General Hypothetical Example Of Probabilities

However, before Narita is discussed in detail, Applicant wishes to present a hypothetical example to evidence the method employed to calculate the probability of selection of the preferred ranges. In this very simple, hypothetical example, there are two components, labeled X and Y. A person is made aware of the desirability of combining Components X and Y, which components can be combined using different quantities of each component. Unfortunately, the person is not aware of what particular quantity of Component X is desirable to combine with a particular quantity of Component Y. However, the person is made aware that the preferred quantity of Component X is one of two possible quantities, specifically, Quantities A and B, and that the preferred quantity of Component Y is one of four possible quantities, specifically, Quantities C, D, E, and F. The person must then choose only one of the quantities of Component X to combine with only one of the quantities of Component Y in the hope of

achieving the desired combination, which in this example is Combination BD (the combination of Quantities B and D). Box A shows the components, quantities, and all possible combinations thereof.

BOX A						
	A			B		
Component X		50%			50%	
	C	D	E	F		
Component Y	25%	25%	25%	25%		
All Possible Combinations	AC, AD, AE, AF, BC, BD, BE, BF					

In order to find the preferred Combination BD, in this example it is assumed that the person must choose first from the available quantities of Component X, that is, between Quantities A and B. Once the person chooses either A or B, he then must choose from the available quantities of Component Y, that is, between Quantities C, D, E, and F, to create a combination. However, as shown in Box A, there are eight possible combinations (AC, AD, AE, AF, BC, BD, BE, BF) of Components X and Y, only one of which combinations, Combination BD, is correct. Therefore, the person has a one in eight chance of picking the preferred quantities to create the preferred combination.

Please note that the chances of selecting only the preferred quantity of Component X in the above example are very good. Since there are only two possible quantities to choose from, the person has

a one in two, or 50%, chance of selecting the preferred Quantity B. Further, the chances of selecting only the preferred quantity of Component Y, though less than Component X, are also fairly good. Since there are only four possible quantities to choose from, the person has a one in four, or 25%, chance of selecting the preferred Quantity D. However, the chances of selecting both of the preferred quantities, and thus the preferred Combination BD, at the same time is one in eight, or 12.5%. It is therefore evident that increasing the number of components to be used in a combination, as well as increasing the number of possible quantities of the components, substantially decreases the chances that a specific combination could be selected by chance from such numerous possibilities.

1c. (B) Specific Example Of Probabilities Using Claim 20 And Narita Reference

This conclusion is evidenced dramatically when examining the teaching of Narita with respect to Claim 20 of the present application, in which example the odds of selecting all of the preferred ranges of Claim 20 from the ranges disclosed in Narita is extremely low. For example, in Narita the content of BaO is within the range of 0 to 30%. In Claim 20, the content of BaO is within the range of greater than 5 to 8.5%, which means that the BaO content is a range that is approximately 3.5%. For a person using Narita as a basis for producing a glass having a BaO content in the range of greater than 5 to 8.5% as disclosed in Claim 20, he would have to pick a range that encompasses 3.5%, such as, for example, 0-3.5% or 7-10.5%, from the overall range of 0-30%.

Please note, however, that there is a tremendous number of

possible ranges of 3.5% in a 0-30% range. Therefore, the chance or probability that the person, using the 0-30% BaO range in Narita as a basis, would pick the approximately 5 to 8.5% BaO range as disclosed in Claim 20 would be very low. To further explain by way of another conservative, hypothetical example, similar to the one above, it could be assumed that Narita shows approximately eight 3.5% ranges, starting with zero and increasing in 3.5% increments, for example, as follows: 0-3.5%, 3.5-7%, 7-10.5%, 10.5-14%, 14-17.5%, 17.5-21%, 21-24.5%, and 24.5-28%. Out of these eight possibilities, it could be assumed that only one is the preferred range for BaO. Therefore, in this example, the person using Narita as a basis would have approximately a one in eight, or 12.5%, chance of selecting the preferred range. As stated above, this is a very conservative example, and it is presented for purposes of argument. The actual chances of selecting the preferred range could be substantially lower since there are a great number of possible 3.5% ranges that could be found in a 0-30% range. It is therefore respectfully submitted that Narita is not sufficiently specific in its disclosed ranges to teach or suggest the invention as claimed in Claim 20 based solely on the slight chance of picking the correct range of BaO.

Assuming for the sake of argument that a person were to essentially "beat the odds" and select the preferred 3.5% range for BaO, he still would have to overcome the odds of picking each and every preferred range for all of the other components. Further, with the addition of each component into the selection process, the odds of selecting some or all of the components in their preferred ranges, even in the conservative example presented herein, are extremely low.

For example, SrO in Narita is found within a range of 0-10%, whereas the SrO range in Claim 20 is 0.1-1.5%. Using the same method used above for BaO, it could be assumed that Narita shows approximately seven 1.4% ranges, starting with zero and increasing in 1.4% increments, for example, as follows: 0-1.4%, 1.4-2.8%, 2.8-4.2%, 4.2-6%, 6-7.4%, 7.4-8.8%, and 8.6-10%. Out of these seven possibilities, it could be assumed that only one is the preferred range for SrO. Therefore, in this example, the person using Narita as a basis would have approximately a one in seven, or 14.3%, chance of selecting the preferred range of SrO.

Assuming, hypothetically, that the person must choose one of eight possible ranges for BaO, and then has to select one of seven possible ranges for SrO, the odds of picking both preferred ranges at the same time increases substantially. To further explain, for every one of the eight possible ranges for BaO, there are seven possible ranges of SrO that could be combined with it. Therefore, there are 56 possible combinations (8 BaO times 7 SrO) of the possible ranges of BaO and SrO. Since only one of the 56 possible combinations is the preferred combination of ranges, the person has a very slight, one in 56, or approximately 2%, chance of selecting the right combination of ranges.

As one can imagine, with each additional component, the chances of choosing all of the preferred ranges increases exponentially. Based on the above method of calculation, even in the very conservative example presented herein below, the odds of choosing all of the preferred ranges as set forth in Claim 20, using Narita as a guide, are approximately on in 3,134,796 (see Table 1).

It is respectfully submitted that such odds would be extremely difficult, if not impossible, to overcome.

1c. (C) Additional Example Of Probabilities Using Claim 20 And Narita Reference And Including Intermediate Ranges

Again, it should be emphasized that the above examples are very conservative. In the above examples, no intermediate ranges were considered, such as 1-4.5% or 2.8-6.3%. Narita could be considered to show an even greater number of possible ranges if intermediate ranges are included and depending on how one determines what the possible ranges are. For example and as stated above, for a person using Narita as a basis for producing a glass having a BaO content in the range disclosed in Claim 20, he would have to pick a range that encompasses about 3.5%, such as 3-6.5% or 17-20.5%, from the overall range of 0-30%. Including intermediate ranges and by counting in 1% increments starting at zero, there are approximately 27 possible ranges of 3.5% in a 0-30% range (0-3.5, 1-4.5, 2-5.5...25-28.5, 26-29.5). Therefore, the person using Narita, in this particular example, would have an approximate 1 in 27 chance, or an approximately 3.7% chance, of picking the range for BaO disclosed in Claim 20. Including intermediate ranges and by counting in 0.5% increments starting at zero, there are approximately 54 possible ranges of 3.5% in a 0-30% range (0-3.5, 0.5-4, 1-4.5...25.5-29, 26-29.5, 26.5-30). Therefore, the person using Narita, in this particular example, would have an approximate 1 in 54 chance, or an approximately 1.85% chance, of picking the range for BaO disclosed in Claim 20.

In view of the above, it is respectfully submitted that the

preferred ranges of all of the components of the present invention as claimed in Claim 20 would not be readily discerned or "clearly envisaged" using the broad ranges of Narita as a guide. It is respectfully submitted that Narita could not reasonably be considered to teach, suggest, disclose, or render obvious the present invention as claimed.

It is thus submitted that the very large ranges for the mentioned eight glass components of the Narita reference cover a great number of different types of borosilicate glass.

Applicants' Claim 20 states:

"A glass comprising:
a substantially alkali-free aluminoborosilicate glass;
said glass having a coefficient of thermal expansion
 $\alpha_{20/300}$ of between $2.8 \times 10^{-6}/K$ and
 $3.8 \times 10^{-6}/K$;
said glass having the composition (in % by weight, based
on oxide):

SiO ₂	> 58 - 65
B ₂ O ₃	> 6 - 10.5
Al ₂ O ₃	> 14 - 25
MgO	0 - < 3
CaO	0 - 9
SrO	0.1 - 1.5
BaO	> 5 - 8.5
with SrO + BaO	≤ 8.6
with MgO + CaO + SrO + BaO	8 - 18
ZnO	0 - < 2." (emphasis added)

It is submitted that Applicants' Claim 20 claims a selection invention of a selection of specific ranges for the specific components of the claimed glass. The ranges of the present invention include only a very small portion of the ranges of the Narita reference. Therefore, the Narita reference is a non-teaching. The

specific characteristics of the present invention result only by selecting the very specific ranges of the specific components. Since there is nothing in the Narita reference that would point to the specific ranges of the specific components of the present invention, it is further submitted that Applicants' selection invention is not obvious over the Narita reference.

In the following, the distinctions between the glass of Narita reference and the glass of Applicants' Claim 20 are analyzed in detail and the analysis is summarized in the following Table 1.

Table 1 - Comparison Of Glass Of Narita et al.
 And Glass Of Applicants' Claim 20

Component or Sum of Components	Narita's Ranges of Components	Overlap between Applicants' Ranges of Components and Narita's Ranges of Components	Ratio of Applicants' Ranges of Components to Narita's Ranges of Components	Running Probability
SiO ₂	30%	7%	0.233	
B ₂ O ₃	15%	4.5%	0.30	1 in 14
Al ₂ O ₃	19%	11%	0.5789	1 in 25
MgO	10%	3%	0.30	1 in 83
CaO	15%	9%	0.60	1 in 138
SrO	10%	1.4%	0.14	1 in 984
BaO	30%	3.5%	0.116	1 in 8,485
ZnO	10%	2%	0.20	1 in 42,373
SrO + BaO	40%	3.5%	0.0875	1 in 483,092
MgO + CaO + SrO + BaO	65%	10%	0.154	1 in 3,134,796

1c. (D.) Explanation Of Ranges Of Components

i. Rang s For Silicon Dioxid And For Boric Oxide

The Narita reference discloses a range of 40 wt% to 70 wt% of SiO₂. Therefore, the total numerical range of SiO₂ that is disclosed in the Narita reference is the difference between 70 wt% and 40 wt% which is 30 wt%. In other words, the part of the 100% possible range of SiO₂ in the Narita reference is 30%, or, expressed in fractional form rather than in terms of percentage, is 0.30 of the possible range of SiO₂. The value of 0.30, or more than one quarter of the possible range of SiO₂, is a substantial part of the possible 100% range of SiO₂.

The Narita reference discloses a range of 5 wt% to 20 wt% of B₂O₃. Therefore, the total numerical range of B₂O₃ that is disclosed in the Narita reference is the difference between 20 wt% and 5 wt% which is 15 wt%. In other words, the part of the 100% possible range of B₂O₃ in the Narita reference is 15%, or, expressed in fractional form rather than in terms of percentage, is 0.15 of the possible range of B₂O₃. The value of 0.15 of the possible range of B₂O₃, is a moderately substantial part of the possible 100% range of B₂O₃.

In contrast to the Narita reference, Applicants' Claim 20 claims a range of SiO₂ from more than 58 wt% to 65 wt%, i.e., a range that overlaps with Narita. Therefore, the total numerical range of SiO₂ that is claimed in Applicants' Claim 20 is the difference between 65 wt% and 58 wt% which is 7 wt% and in overlap with the Narita reference. In other words, the part of the 100% possible range of SiO₂ claimed in Claim 20 is 7%, or, expressed in fractional form

rather than in terms of percentage, is 0.07 of the possible range of SiO₂. The value of 0.07 of the possible range of SiO₂ is a small part of the possible 100 % range of SiO₂.

Further in contrast to the Narita reference, Applicants' Claim 20 claims a range of B₂O₃ from more than 6 wt% to 10.5 wt%. Therefore, the total numerical range of B₂O₃ that is claimed in Applicants' Claim 20 is the difference between 10.5 wt% and 6 wt% which is 4.5 wt%. In other words, the part of the 100% possible range of B₂O₃ claimed in Claim 20 is 4.5 %, or, expressed in fractional form rather than in terms of percentage, is 0.045 of the possible range of B₂O₃. The value of 0.045 of the possible range of B₂O₃ is a small part of the possible 100% range of B₂O₃.

For SiO₂, the Narita reference discloses a range of 30 wt% and Applicants' Claim 20 claims a range of 7 wt%. The quotient of 7 wt% over 30 wt% represents the ratio of the range of SiO₂ as claimed in Claim 20 compared to the range of SiO₂ as disclosed in the Narita reference. The quotient is 0.233. In other words, for SiO₂, the 7% of the range of Claim 20 is only 23% of the range of the Narita reference, which range of the Narita reference is 30% of the 100% possible range of the Narita reference.

For B₂O₃, the Narita reference discloses a range of 15 wt% and Applicants' Claim 20 claims a range of 4.5 wt% which is in overlap with the Narita reference. The quotient of 4.5 wt% over 15 wt% represents the ratio of the range of B₂O₃ as claimed in Claim 20 compared to the range of B₂O₃ as disclosed in the Narita reference. The quotient is 0.30. In other words, for B₂O₃, the 4.5% of the range

of Claim 20 is only 30% of the range of the Narita reference, which range of the Narita reference is 15% of the 100% possible range of the Narita reference.

As is well known in the mathematics of combinations and probabilities, when two sub-ranges of two separate possible ranges are considered, the portion of the total range of the two separate possible ranges that these ranges take up is the product of the fraction that the first range takes up in the first possible range times the fraction that the second range takes up in the second possible range.

Expressed differently, the probability of all the possible ranges and the position of all the possible ranges that the two ranges of SiO₂ and B₂O₃ occupy in the two possible greater ranges, that is to say, of all the possible ranges in the two large ranges, that is, in the case of SiO₂, 30 wt% for the Narita reference and 7 wt% for Claim 20 and, in the case of B₂O₃, 15 wt% for the Narita reference and 4.5 wt% for Claim 20, is the product of 0.233 times 0.30, which is equal to 0.0699.

Expressed differently, the probability that the two ranges of SiO₂ and B₂O₃ would encompass the ranges of Claim 20 is 0.0699 or 6.99%.

Thus, in the case of a 0.233 chance for SiO₂ and a 0.30 chance for B₂O₃, the probability that these two would exist together in Applicants' Claim 20 on the basis of the Narita reference is only a 6.99% chance. That means that 93.01% of the possible ranges of SiO₂ and B₂O₃ would lie outside of the ranges claimed for SiO₂ and B₂O₃. In other words, the possibility that these two ranges would be

in different positions in the ranges of the Narita reference is 93.01% and would lie outside the ranges claimed in Claim 20.

It is submitted that the low percentage of 6.99% is a very small percentage of the total range of possibilities as suggested in the Narita reference. The reciprocal of 0.0699 is 14.30. In other words, Applicants' Claim 20 covers only $\frac{1}{14}$ of the ranges as disclosed by the Narita reference for the two components, SiO_2 and B_2O_3 .

Accordingly, the probability of a person skilled in the art choosing the ranges of Claim 20 of from more than of 58 wt% to 65 wt% for SiO_2 and of from more than 6 wt% to 10.5 wt% for B_2O_3 , while being aware of the ranges of from 40 wt% to 70 wt% for SiO_2 and of from 5 wt% to 20 wt% for B_2O_3 in the Narita reference, is **only 6.99%**. Therefore, 93.01% of the possible ranges for SiO_2 and B_2O_3 of the Narita reference represent the probability of being outside of the claimed ranges for SiO_2 and B_2O_3 . In contrast, Applicants' Claim 20 covers only a $\frac{1}{14}$ probability of the ranges as disclosed in the Narita reference.

Thus, Applicants' Claim 20 claims a very small range, which represents a very small probability, of SiO_2 and B_2O_3 compared to these two components of the Narita reference. Therefore, the Narita reference does not make obvious Applicants' Claim 20 with respect to the ranges of SiO_2 and B_2O_3 .

ii. Ranges For Aluminum Oxide

The Narita reference discloses a range of 6 wt% to 25 wt% of Al_2O_3 . Therefore, the total numerical range of Al_2O_3 that is disclosed in the Narita reference is the difference between 25 wt% and 6 wt% which is 19 wt%. In other words, the part of the

100% possible range of Al₂O₃ in the Narita reference is 19%, or, expressed in fractional form rather than in terms of percentage, is 0.19 of the possible range of Al₂O₃. The value of 0.19 is a moderately substantial part of the possible 100% range of Al₂O₃.

In contrast to the Narita reference, Applicants' Claim 20 claims a range of Al₂O₃ from more than 14 wt% to 25 wt%. Therefore, the total numerical range of Al₂O₃ that is claimed in Applicants' Claim 20 is the difference between 25 wt% and 14 wt% which is 11 wt%. In other words, the part of the 100% possible range of Al₂O₃ claimed in Claim 20 is 11%, or, expressed in fractional form rather than in terms of percentage, is 0.11 of the possible range of Al₂O₃. The value of 0.11 of the possible range of Al₂O₃ is a moderately substantial part of the possible 100% range of Al₂O₃.

For Al₂O₃, the Narita reference discloses a range of 19 wt% and Applicants' Claim 20 claims a range of 11 wt% which is in overlap with the Narita reference. The quotient of 11 wt% over 19 wt% represents the ratio of the range of Al₂O₃ as claimed in Claim 20 compared to the range of Al₂O₃ as disclosed in the Narita reference. The quotient is 0.5789. In other words, for Al₂O₃, the 11% of the range of Claim 20 is 58% of the range of the Narita reference, which range of the Narita reference is 19% of the 100% possible range of the Narita reference.

Applying the above-described probability calculation to the three glass components, SiO₂, B₂O₃, and Al₂O₃, the probability that the three ranges would encompass the ranges of Claim 20 is 0.0699 times 0.5789 which is 0.04046 or 4.05%.

Thus, in the case of a 0.233 chance for SiO₂, a 0.30 chance for

B_2O_3 , and a 0.5789 chance for Al_2O_3 , the probability that these three would exist together in Applicants' Claim 20 on the basis of the Narita reference is only a 4.05% chance. That means that 95.95% of the possible ranges of SiO_2 , B_2O_3 and Al_2O_3 would lie outside of the ranges claimed for SiO_2 , B_2O_3 , and Al_2O_3 . In other words, the possibility that these three ranges would be in different positions in the ranges of the Narita reference is 95.95% and would lie outside the ranges claimed in Claim 20.

It is again submitted that the low percentage of 4.05% is a very small percentage of the total range of possibilities as suggested in the Narita reference. The reciprocal of 0.04046 is 24.71. In other words, Applicants' Claim 20 covers only $1/_{25}$ of the ranges as disclosed by the Narita reference for the three components, SiO_2 , B_2O_3 , and Al_2O_3 .

Accordingly, since the probability of a person skilled in the art choosing the ranges of Claim 20 of from more than of 58 wt% to 65 wt% for SiO_2 , of from more than 6 wt% to 10.5 wt% for B_2O_3 , and of from more than 14 wt% to 25 wt% for Al_2O_3 , while being aware of the ranges of from 40 wt% to 70 wt% for SiO_2 , of from 5 wt% to 20 wt% for B_2O_3 , and of from 6 wt% to 25 wt% for Al_2O_3 in the Narita reference, is **only 4.05%**. Therefore 95.95% of the possible ranges for SiO_2 , B_2O_3 , and Al_2O_3 for the Narita reference represent the probability of being outside of the claimed ranges for SiO_2 , B_2O_3 , and Al_2O_3 . In contrast, Applicants' Claim 20 covers only $1/_{25}$ probability of the ranges as disclosed in the Narita reference.

Thus, Applicants' Claim 20 claims a very small range, which represents a very small probability, of SiO_2 , B_2O_3 , and Al_2O_3 compared

to these three components of the Narita reference. Therefore, the Narita reference does not make obvious Applicants' Claim 20 with respect to the ranges of SiO₂, B₂O₃, and Al₂O₃.

iii. Ranges For Magnesium Oxide

The Narita reference discloses a range of 0 wt% to 10 wt% of MgO. Therefore, the total numerical range of MgO that is disclosed in the Narita reference is the difference between 10 wt% and 0 wt% which is 10 wt%. In other words, the part of the 100% possible range of MgO in the Narita reference is 10%, or, expressed in fractional form rather than in terms of percentage, is 0.10 of the possible range of MgO. The value of 0.1 is a moderately substantial part of the possible 100% range of MgO.

In contrast to the Narita reference, Applicants' Claim 20 claims a range of MgO from 0 wt% to less than 3 wt%. Therefore, the total numerical range of MgO that is claimed in Applicants' Claim 20 is the difference between 3 wt% and 0 wt% which is 3 wt%. In other words, the part of the 100% possible range of MgO claimed in Claim 20 is 3%, or, expressed in fractional form rather than in terms of percentage, is 0.03 of the possible range of MgO. The value of 0.03 of the possible range of MgO is a small part of the possible 100% range of MgO.

For MgO, the Narita reference discloses a range of 10 wt% and Applicants' Claim 20 claims a range of 3 wt% which is in overlap with the Narita reference. The quotient of 3 wt% over 10 wt% represents the ratio of the range of MgO as claimed in Claim 20 compared to the range of MgO as disclosed in the Narita reference. The quotient is 0.30. In other words, for MgO, the 3% of the range

of Claim 20 is 30% of the range of the Narita reference, which range of the Narita reference is 10% of the 100% possible range of the Narita reference.

Applying the above-described probability calculation to the four glass components, SiO_2 , B_2O_3 , Al_2O_3 , and MgO , the probability that the four ranges would encompass the ranges of Claim 20 is 0.04046 times 0.30 which is 0.0121 or 1.2%.

Thus, in the case of a 0.233 chance for SiO_2 , a 0.30 chance for B_2O_3 , a 0.5789 chance for Al_2O_3 , and a 0.3 chance for MgO , the probability that these four would exist together in Applicants' Claim 20 on the basis of the Narita reference is only a 1.2% chance. That means that 98.8% of the possible ranges of SiO_2 , B_2O_3 , Al_2O_3 , and MgO would lie outside of the ranges claimed for SiO_2 , B_2O_3 , Al_2O_3 , and MgO . In other words, the possibility that these four ranges would be in different positions in the ranges of the Narita reference is 98.8% and would lie outside the ranges claimed in Claim 20.

It is again submitted that the low percentage of 1.2% is a very small percentage of the total range of possibilities as suggested in the Narita reference. The reciprocal of 0.0121 is 82.648. In other words, Applicants' Claim 20 covers only $1/83$ of the ranges as disclosed by the Narita reference for the four components, SiO_2 , B_2O_3 , Al_2O_3 , and MgO .

Accordingly, the probability of a person skilled in the art choosing the ranges of Claim 20 of from more than of 58 wt% to 65 wt% for SiO_2 , of from more than 6 wt% to 10.5 wt% for B_2O_3 , of from more than 14 wt% to 25 wt% for Al_2O_3 , and of from 0 wt% to less than 3 wt% for MgO , while being aware of the ranges of from 40 wt%

to 70 wt% for SiO₂, of from 5 wt% to 20 wt% for B₂O₃, of from 6 wt% to 25 wt% for Al₂O₃, and of from 0 wt% to 10 wt% for MgO in the Narita reference, is **only 1.2%**. Therefore, 98.8% of the possible ranges for SiO₂, B₂O₃, Al₂O₃, and MgO of the Narita reference represent the probability of being outside of the claimed ranges for SiO₂, B₂O₃, Al₂O₃, and MgO. In contrast, Applicants' Claim 20 covers only $\frac{1}{83}$ probability of the ranges as disclosed in the Narita reference.

Thus, Applicants' Claim 20 claims a very small range, which represents a very small probability, of SiO₂, B₂O₃, Al₂O₃, and MgO compared to these four components of the Narita reference. Therefore, the Narita reference does not make obvious Applicants' Claim 20 with respect to the ranges of SiO₂, B₂O₃, Al₂O₃, and MgO.

iv. Ranges For Calcium Oxide

The Narita reference discloses a range of 0 wt% to 15 wt% of CaO. Therefore, the total numerical range of CaO that is disclosed in the Narita reference is the difference between 15 wt% and 0 wt% which is 15 wt%. In other words, the part of the 100% possible range of CaO in the Narita reference is 15%, or, expressed in fractional form rather than in terms of percentage, is 0.15 of the possible range of CaO. The value of 0.15 is a moderately substantial part of the possible 100% range of CaO.

In contrast to the Narita reference, Applicants' Claim 20 claims a range of CaO from 0 wt% to 9 wt%. Therefore, the total numerical range of CaO that is claimed in Applicants' Claim 20 is the difference between 9 wt% and 0 wt% which is 9 wt%. In other words, the part of the 100% possible range of CaO claimed in Claim 20 is 9%, or, expressed in fractional form rather than in terms of percentage, is

0.09 of the possible range of CaO. The value of 0.09 of the possible range of CaO is a small part of the possible 100% range of CaO.

For CaO, the Narita reference discloses a range of 15 wt% and Applicants' Claim 20 claims a range of 9 wt% which is in overlap with the Narita reference. The quotient of 9 wt% over 15 wt% represents the ratio of the range of CaO as claimed in Claim 20 compared to the range of CaO as disclosed in the Narita reference. The quotient is 0.6. In other words, for CaO, the 9% of the range of Claim 20 is 60% of the range of the Narita reference, which range of the Narita reference is 15% of the 100% possible range of the Narita reference.

Applying the above-described probability calculation to the five glass components, SiO₂, B₂O₃, Al₂O₃, MgO, and CaO the probability that the five ranges would encompass the ranges of Claim 20 is 0.0121 times 0.6 which is 0.00726 or 0.7%.

Thus, in the case of a 0.233 chance for SiO₂, a 0.30 chance for B₂O₃, a 0.5789 chance for Al₂O₃, a 0.3 chance for MgO, and a 0.6 chance for CaO, the probability that these five would exist together in Applicants' Claim 20 on the basis of the Narita reference is only a 0.7% chance. That means that 99.3% of the possible ranges of SiO₂, B₂O₃, Al₂O₃, MgO, and CaO would lie outside of the ranges claimed for SiO₂, B₂O₃, Al₂O₃, MgO, and CaO. In other words, the possibility that these five ranges would be in different positions in the ranges of the Narita reference is 99.3% and would lie outside the ranges claimed in Claim 20.

It is again submitted that the low percentage of 0.7% is a very small percentage of the total range of possibilities as suggested in

the Narita reference. The reciprocal of 0.00726 is 137.74. In other words, Applicants' Claim 20 covers only $\frac{1}{138}$ of the ranges as disclosed by the Narita reference for the five components, SiO_2 , B_2O_3 , Al_2O_3 , MgO , and CaO .

Accordingly, the probability of a person skilled in the art choosing the ranges of Claim 20 of from more than of 58 wt% to 65 wt% for SiO_2 , of from more than 6 wt% to 10.5 wt% for B_2O_3 , of from more than 14 wt% to 25 wt% for Al_2O_3 , of from 0 wt% to less than 3 wt% for MgO , and of from 0 wt% to 9 wt% for CaO , while being aware of the ranges of from 40 wt% to 70 wt% for SiO_2 , of from 5 wt% to 20 wt% for B_2O_3 , of from 6 wt% to 25 wt% for Al_2O_3 , of from 0 wt% to 10 wt% for MgO , and of from 0 wt% to 15 wt% for CaO in the Narita reference, is **only 0.7%**. Therefore, 99.3% of the possible ranges for SiO_2 , B_2O_3 , Al_2O_3 , MgO , and CaO of the Narita reference represent the probability of being outside of the claimed ranges for SiO_2 , B_2O_3 , Al_2O_3 , MgO , and CaO . In contrast, Applicants' Claim 20 covers only a $\frac{1}{138}$ probability of the ranges as disclosed in the Narita reference.

Thus, Applicants' Claim 20 claims a very small range, which represents a very small probability, of SiO_2 , B_2O_3 , Al_2O_3 , MgO , and CaO compared to these five components of the Narita reference. Therefore, the Narita reference does not make obvious Applicants' Claim 20 with respect to the ranges of SiO_2 , B_2O_3 , Al_2O_3 , MgO , and CaO .

v. Ranges For Strontium Oxide

The Narita reference discloses a range of 0 wt% to 10 wt% of SrO . Therefore, the total numerical range of SrO that is

disclosed in the Narita reference is the difference between 10 wt% and 0 wt% which is 10 wt%. In other words, the part of the 100% possible range of SrO in the Narita reference is 10%, or, expressed in fractional form rather than in terms of percentage, is 0.10 of the possible range of SrO. The value of 0.10 is a moderately substantial part of the possible 100% range of SrO.

In contrast to the Narita reference, Applicants' Claim 20 claims a range of SrO from 0.1 wt% to 1.5 wt%. Therefore, the total numerical range of SrO that is claimed in Applicants' Claim 20 is the difference between 1.5 wt% and 0.1 wt% which is 1.4 wt%. In other words, the part of the 100% possible range of SrO claimed in Claim 20 is 1.4%, or, expressed in fractional form rather than in terms of percentage, is 0.014 of the possible range of SrO. The value of 0.014 of the possible range of SrO is a small part of the possible 100% range of SrO.

For SrO, the Narita reference discloses a range of 10 wt% and Applicants' Claim 20 claims a range of 1.4 wt% which is in overlap with the Narita reference. The quotient of 1.4 wt% over 10 wt% represents the ratio of the range of SrO as claimed in Claim 20 compared to the range of SrO as disclosed in the Narita reference. The quotient is 0.14. In other words, for SrO, the 1.4% of the range of Claim 20 is 14% of the range of the Narita reference, which range of the Narita reference is 10% of the 100% possible range of the Narita reference.

Applying the above-described probability calculation to the six glass components, SiO₂, B₂O₃, Al₂O₃, MgO, CaO, and SrO, the probability that the six ranges would encompass the ranges of Claim

20 is 0.00726 times 0.14 which is 0.001016 or 0.102%.

Thus, in the case of a 0.233 chance for SiO₂, a 0.30 chance for B₂O₃, a 0.5789 chance for Al₂O₃, a 0.3 chance for MgO, a 0.6 chance for CaO, and a 0.14 chance for SrO the probability that these six would exist together in Applicants' Claim 20 on the basis of the Narita reference is only a 0.102% chance. That means that 99.898% of the possible ranges of SiO₂, B₂O₃, Al₂O₃, MgO, CaO, and SrO would lie outside of the ranges claimed for SiO₂, B₂O₃, Al₂O₃, MgO, CaO, and SrO. In other words, the possibility that these six ranges would be in different positions in the ranges of the Narita reference is 99.898% and would lie outside the ranges claimed in Claim 20.

It is again submitted that the low percentage of 0.102% is a very small percentage of the total range of possibilities as suggested in the Narita reference. The reciprocal of 0.001016 is 983.86. In other words, Applicants' Claim 20 covers only $\frac{1}{984}$ of the ranges as disclosed by the Narita reference for the six components, SiO₂, B₂O₃, Al₂O₃, MgO, CaO, and SrO.

Accordingly, the probability of a person skilled in the art choosing the ranges of Claim 20 of from more than of 58 wt% to 65 wt% for SiO₂, of from more than 6 wt% to 10.5 wt% for B₂O₃, of from more than 14 wt% to 25 wt% for Al₂O₃, of from 0 wt% to less than 3 wt% for MgO, of from 0 wt% to 9 wt% for CaO, and of from 0.1 wt% to 1.5 wt% for SrO, while being aware of the ranges of from 40 wt% to 70 wt% for SiO₂, of from 5 wt% to 20 wt% for B₂O₃, of from 6 wt% to 25 wt% for Al₂O₃, of from 0 wt% to 10 wt% for MgO, of from 0 wt% to 15 wt% for CaO, and of from 0 wt% to 10 wt% for SrO in the Narita reference, is **only 0.102%**. Therefore, 99.898% of the possible

ranges for SiO₂, B₂O₃, Al₂O₃, MgO, CaO, and SrO of the Narita reference represent the probability of being outside of the claimed ranges for SiO₂, B₂O₃, Al₂O₃, MgO, CaO, and SrO. In contrast, Applicants' Claim 20 covers only a $\frac{1}{984}$ probability of the range as disclosed in the Narita reference.

Thus, Applicants' Claim 20 claims a very small range, which represents a very small probability, of SiO₂, B₂O₃, Al₂O₃, MgO, CaO, and SrO compared to these six components of the Narita reference. Therefore, the Narita reference does not make obvious Applicants' Claim 20 with respect to the ranges of SiO₂, B₂O₃, Al₂O₃, MgO, CaO, and SrO.

vi. Ranges For Barium Oxide

The Narita reference discloses the large range of 0 wt% to 30 wt% of BaO. Therefore, the total numerical range of BaO that is disclosed in the Narita reference is the difference between 30 wt% and 0 wt% which is 30 wt%. In other words, the part of the 100% possible range of BaO in the Narita reference is 30%, or, expressed in fractional form rather than in terms of percentage, is 0.30 of the possible range of BaO. The value of 0.30 is a moderately substantial part of the possible 100% range of BaO.

In contrast to the Narita reference, Applicants' Claim 20 claims a range of BaO from more than 5 wt% to 8.5 wt%. Therefore, the total numerical range of BaO that is claimed in Applicants' Claim 20 is the difference between 8.5 wt% and 5 wt% which is 3.5 wt%. In other words, the part of the 100% possible range of BaO claimed in Claim 20 is 3.5%, or, expressed in fractional form rather than in terms of percentage, is 0.035 of the possible range of BaO. The value of

0.035 of the possible range of BaO is a small part of the possible 100% range of BaO.

For BaO, the Narita reference discloses a range of 30 wt% and Applicants' Claim 20 claims a range of 3.5 wt% which is the overlap with the Narita et al reference. The quotient of 3.5 wt% over 30 wt% represents the ratio of the range of BaO as claimed in Claim 20 compared to the range of BaO as disclosed in the Narita reference. The quotient is 0.116. In other words, for BaO, the 3.5% of the range of Claim 20 is 12% of the range of the Narita reference, which range of the Narita reference is 30% of the 100% possible range of the Narita reference.

Applying the above-described probability calculation to the seven glass components, SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, and BaO the probability that the seven ranges would encompass the ranges of Claim 20 is 0.001016 times 0.116 which is 0.000118 or 0.012%.

Thus, in the case of a 0.233 chance for SiO₂, a 0.30 chance for B₂O₃, a 0.5789 chance for Al₂O₃, a 0.3 chance for MgO, a 0.6 chance for CaO, a 0.14 chance for SrO, and a 0.116 chance for BaO the probability that these seven would exist together in Applicants' Claim 20 on the basis of the Narita reference is only a 0.012% chance. That means that 99.988% of the possible ranges of SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, and BaO would lie outside of the ranges claimed for SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, and BaO. In other words, the possibility that these seven ranges would be in different positions in the ranges of the Narita reference is 99.988% and would lie outside the ranges claimed in Claim 20.

It is again submitted that the low percentage of 0.012% is a

very small percentage of the total range of possibilities as suggested in the Narita reference. The reciprocal of 0.000118 is 8484.9. In other words, Applicants' Claim 20 covers only $\frac{1}{8485}$ of the ranges as disclosed by the Narita reference for the seven components, SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, and BaO.

Accordingly, the probability of a person skilled in the art choosing the ranges of Claim 20 of from more than of 58 wt% to 65 wt% for SiO₂, of from more than 6 wt% to 10.5 wt% for B₂O₃, of from more than 14 wt% to 25 wt% for Al₂O₃, of from 0 wt% to less than 3 wt% for MgO, of from 0 wt% to 9 wt% for CaO, of from 0.1 wt% to 1.5 wt% for SrO, and of from more than 5 wt% to 8.5 wt% for BaO, while being aware of the ranges of from 40 wt% to 70 wt% for SiO₂, of from 5 wt% to 20 wt% for B₂O₃, of from 6 wt% to 25 wt% for Al₂O₃, of from 0 wt% to 10 wt% for MgO, of from 0 wt% to 15 wt% for CaO, of from 0 wt% to 10 wt% for SrO, and of from 0 wt% to **30 wt% for BaO** in the Narita reference, is **only 0.012%**. Therefore, 99.988% of the possible ranges for SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, and BaO of the Narita reference represent the probability of being outside of the claimed ranges for SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, and BaO. In contrast, Applicants' Claim 20 covers only a $\frac{1}{8485}$ probability of the ranges as disclosed in the Narita reference.

Thus, Applicants' Claim 20 claims a very small range, which represents a very small probability, of SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, and BaO compared to these seven components of the Narita reference. Therefore, the Narita reference does not make obvious Applicants' Claim 20 with respect to the ranges of SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, and BaO.

vii. Rang s For Zinc Oxid

The Narita reference discloses the range of 0 wt% to 10 wt% of ZnO. Therefore, the total numerical range of ZnO that is disclosed in the Narita reference is the difference between 10 wt% and 0 wt% which is 10 wt%. In other words, the part of the 100% possible range of BaO in the Narita reference is 10%, or, expressed in fractional form rather than in terms of percentage, is 0.10 of the possible range of ZnO. The value of 0.10 is a moderately substantial part of the possible 100% range of ZnO.

In contrast to the Narita reference, Applicants' Claim 20 claims a range of ZnO from 0 wt% to less than 2 wt%. Therefore, the total numerical range of ZnO that is claimed in Applicants' Claim 20 is the difference between 2 wt% and 0 wt% which is 2 wt%. In other words, the part of the 100% possible range of ZnO claimed in Claim 20 is 2%, or, expressed in fractional form rather than in terms of percentage, is 0.02 of the possible range of ZnO. The value of 0.02 of the possible range of ZnO is a small part of the possible 100% range of ZnO.

For ZnO, the Narita reference discloses a range of 10 wt% and Applicants' Claim 20 claims a range of 2 wt% which is in overlap with the Narita reference. The quotient of 2 wt% over 10 wt% represents the ratio of the range of ZnO as claimed in Claim 20 compared to the range of ZnO as disclosed in the Narita reference. The quotient is 0.20. In other words, for ZnO, the 2% of the range of Claim 20 is 20% of the range of the Narita reference, which range of the Narita reference is 10% of the 100% possible range of the Narita reference.

Applying the above-described probability calculation to the eight glass components, SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, BaO, and ZnO, the probability that the eight ranges would encompass the ranges of Claim 20 is 0.000118 times 0.20 which is 0.0000236 or 0.00236% or 23.6 x 10⁻⁴%.

Thus, in the case of a 0.233 chance for SiO₂, a 0.30 chance for B₂O₃, a 0.5789 chance for Al₂O₃, a 0.3 chance for MgO, a 0.6 chance for CaO, a 0.14 chance for SrO, a 0.116 chance for BaO, and a 0.20 chance for ZnO the probability that these eight would exist together in Applicants' Claim 20 on the basis of the Narita reference is only a 23.6 x 10⁻⁴% chance. That means that 99.99764% of the possible ranges of SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, BaO, and ZnO would lie outside of the ranges claimed for SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, BaO, and ZnO. In other words, the possibility that these eight ranges would be in different positions in the ranges of the Narita reference is 99.99764% and would lie outside the ranges claimed in Claim 20.

It is again submitted that the low percentage of 0.00236% is a very small percentage of the total range of possibilities as suggested in the Narita reference. The reciprocal of 0.0000236 is 42,372.88. In other words, Applicants' Claim 20 covers only 1/₄₂₃₇₃ of the ranges as disclosed by the Narita reference for the eight components, SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, BaO, and ZnO.

Accordingly, the probability of a person skilled in the art choosing the ranges of Claim 20 of from more than of 58 wt% to 65 wt% for SiO₂, of from more than 6 wt% to 10.5 wt% for B₂O₃, of from more than 14 wt% to 25 wt% for Al₂O₃, of from 0 wt% to less than 3 wt% for MgO, of from 0 wt% to 9 wt% for CaO, of from 0.1 wt% to

1.5 wt% for SrO, of from more than 5 wt% to 8.5 wt% for BaO, and of from 0 wt% to less than 2 wt% for ZnO, while being aware of the ranges of from 40 wt% to 70 wt% for SiO₂, of from 5 wt% to 20 wt% for B₂O₃, of from 6 wt% to 25 wt% for Al₂O₃, of from 0 wt% to 10 wt% for MgO, of from 0 wt% to 15 wt% for CaO, of from 0 wt% to 10 wt% for SrO, of from 0 wt% to **30 wt% for BaO**, and of from 0 wt% to 10 wt% for ZnO in the Narita reference, is **only** $23.6 \times 10^{-4}\%$. Therefore, 99.99764% of the possible ranges for SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, BaO, and ZnO of the Narita reference represent the probability of being outside of the claimed ranges for SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, BaO, and ZnO. In contrast, Applicants' Claim 20 covers only a $^1_{42373}$ probability of the ranges as disclosed in the Narita reference.

Thus, Applicants' Claim 20 claims a very small range, which represents a very small probability, of SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, BaO, and ZnO compared to these eight components of the Narita reference. Therefore, the Narita reference does not make obvious Applicants' Claim 20 with respect to the ranges of SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, BaO, and ZnO.

viii. Ranges For Sum Of Strontium Oxide Plus Barium Oxide

For the sum of SrO plus BaO Applicants claim a range of less than 8.6 wt%.

The Narita reference does not disclose any range for the sum of SrO plus BaO.

However, for the completeness of the presentation regarding Claim 20, in the following the probability of such limits using the foregoing calculation is presented.

The Narita reference discloses the range of 0 wt% to 10 wt% of SrO. Therefore, the total numerical range of SrO that is disclosed in the Narita reference is the difference between 10 wt% and 0 wt% which is 10 wt%.

The Narita reference discloses the very large range of 0 wt% to 30 wt% of BaO. Therefore, the total numerical range of BaO that is disclosed in the Narita reference is the difference between 30 wt% and 0 wt% which is 30 wt%.

In the case of the Narita reference, the sum of SrO plus BaO is 10 wt% of SrO plus 30 wt% of BaO which is equal to 40 wt%.

In contrast to the Narita reference, Applicants' Claim 20 claims a range of less than 8.6 wt% for SrO plus BaO. Claim 20 also recites a minimum of 0.1 wt% for SrO and a minimum of greater than 5 wt% for BaO, for a minimum total for SrO plus BaO of 5.1 wt%. Therefore, the total numerical range of SrO plus BaO that is claimed in Applicants' Claim 20 is the difference between 8.6 wt% and 5.1 wt% which is 3.5 wt%.

For SrO plus BaO, the Narita reference discloses a range of 40 wt% and Applicants' Claim 20 claims a range of 3.5 wt% which is in overlap with the Narita reference. The quotient of 3.5 wt% over 40 wt% represents the ratio of the range of SrO plus BaO as claimed in Claim 20 compared to the range of SrO plus BaO as disclosed in the Narita reference. The quotient is 0.0875. In other words, for SrO plus BaO, the 3.5% of the range of Claim 20 is 9% of the range of the Narita reference, which range of the Narita reference is 40% of the 100% possible range of the Narita reference.

Applying the above-described probability calculation to the eight

glass components, SiO_2 , B_2O_3 , Al_2O_3 , MgO , CaO , SrO , BaO , and ZnO , and the sum of SrO plus BaO , the probability that the nine ranges would encompass the ranges of Claim 20 is 0.0000236 times 0.0.0875 which is 0.00000207 or 0.000207% or $2.07 \times 10^{-4}\%$.

Thus, in the case of a 0.233 chance for SiO_2 , a 0.30 chance for B_2O_3 , a 0.5789 chance for Al_2O_3 , a 0.3 chance for MgO , a 0.6 chance for CaO , a 0.14 chance for SrO , a 0.116 chance for BaO , and a 0.20 chance for ZnO , and a 0.0875 chance for the sum of SrO plus BaO the probability that these nine would exist together in Applicants' Claim 20 on the basis of the Narita reference is only a $2.07 \times 10^{-4}\%$. That means that 99.99999793% of the possible ranges of SiO_2 , B_2O_3 , Al_2O_3 , MgO , CaO , SrO , BaO , and ZnO , and the sum of SrO plus BaO would lie outside of the ranges claimed for SiO_2 , B_2O_3 , Al_2O_3 , MgO , CaO , SrO , BaO , and ZnO , and the sum of SrO plus BaO . In other words, the possibility that these nine ranges would be in different positions in the ranges of the Narita reference is 99.99999793% and would lie outside the ranges claimed in Claim 20.

It is again submitted that the low percentage of $2.07 \times 10^{-4}\%$ is an extremely small percentage of the total range of possibilities as suggested in the Narita reference. The reciprocal of 0.00000207 is 483,092. In other words, Applicants' Claim 20 covers only $1/_{483092}$ of the ranges as disclosed by the Narita reference for the eight components, SiO_2 , B_2O_3 , Al_2O_3 , MgO , CaO , SrO , BaO , and ZnO , and the sum of SrO plus BaO .

Accordingly, the probability of a person skilled in the art choosing the ranges of Claim 20 of from more than of 58 wt% to 65 wt% for SiO_2 , of from more than 6 wt% to 10.5 wt% for B_2O_3 , of from

more than 14 wt% to 25 wt% for Al₂O₃, of from 0 wt% to less than 3 wt% for MgO, of from 0 wt% to 9 wt% for CaO, of from 0.1 wt% to 1.5 wt% for SrO, of from more than 5 wt% to 8.5 wt% for BaO, and of from 0 wt% to less than 2 wt% for ZnO, with the sum of SrO plus BaO of from more than 5.1 wt% to 8.6 wt%, while being aware of the ranges of from 40 wt% to 70 wt% for SiO₂, of from 5 wt% to 20 wt% for B₂O₃, of from 6 wt% to 25 wt% for Al₂O₃, of from 0 wt% to 10 wt% for MgO, of from 0 wt% to 15 wt% for CaO, of from 0 wt% to 10 wt% for SrO, of from 0 wt% to 30 wt% for BaO, and of from 0 wt% to 10 wt% for ZnO, and with the sum of SrO plus BaO of 40 wt% in the Narita reference, is **only 2.07 x 10⁻⁴%**. Therefore, 99.99999793% of the possible ranges for SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, BaO, and ZnO, and the sum of SrO plus BaO of the Narita reference represent the probability of being outside of the claimed ranges for SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, BaO, and ZnO, and the sum of SrO plus BaO. In contrast, Applicants' Claim 20 covers only a $1/_{483092}$ probability as disclosed in the Narita reference.

Thus, Applicants' Claim 20 claims an extremely small range, which represents an extremely small probability, of SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, BaO, and ZnO, and the sum of SrO plus BaO compared to the these eight components and the sum of SrO plus BaO of the Narita reference. Therefore, the Narita reference does not make obvious Applicants' Claim 20 with respect to the ranges of SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, BaO, and ZnO, and the sum of SrO plus BaO.

ix. Ranges For Sum Of Magnesium Oxide plus Calcium Oxide Plus Strontium Oxide Plus Barium Oxide

For the sum of MgO plus CaO plus SrO plus BaO, Applicants claim the range of from 8 wt% to 18 wt%.

The Narita reference does not disclose any range for the sum of MgO plus CaO plus SrO plus BaO.

However, for the completeness of the presentation regarding Claim 20, in the following the probability of such limits using the foregoing calculation is presented.

The Narita reference discloses the range of 0 wt% to 10 wt% of MgO. Therefore, the total numerical range of MgO that is disclosed in the Narita reference is the difference between 10 wt% and 0 wt% which is 10 wt%.

The Narita reference discloses the range of 0 wt% to 15 wt% of CaO. Therefore, the total numerical range of CaO that is disclosed in the Narita reference is the difference between 15 wt% and 0 wt% which is 15 wt%.

The Narita reference discloses the range of 0 wt% to 10 wt% of SrO. Therefore, the total numerical range of SrO that is disclosed in the Narita reference is the difference between 10 wt% and 0 wt% which is 10 wt%.

The Narita reference discloses the very large range of 0 wt% to 30 wt% of BaO. Therefore, the total numerical range of BaO that is disclosed in the Narita reference is the difference between 30 wt% and 0 wt% which is 30 wt%.

In the case of the Narita reference, the sum of MgO plus CaO plus SrO plus BaO is 10 wt% of MgO plus 15 wt% of CaO plus 10 wt% of SrO plus 30 wt% of BaO which is equal to 65 wt%.

In contrast to the Narita reference, Applicants' Claim 20 claims a

range of from 8 wt% to 18 wt% for the sum of MgO plus CaO plus SrO plus BaO. Therefore, the total numerical range of MgO plus CaO plus SrO plus BaO that is claimed in Applicants' Claim 20 is the difference between 18 wt% and 8 wt% which is 10 wt%.

For MgO plus CaO plus SrO plus BaO, the Narita reference discloses a range of 65 wt% and Applicants' Claim 20 claims a range of 10 wt%. The quotient of 10 wt% over 65 w% represents the ratio of the range of the sum of MgO plus CaO plus SrO plus BaO claimed in Claim 20 compared to the range of the sum of MgO plus CaO plus SrO plus BaO as disclosed in the Narita reference. The quotient is 0.154. In other words, for the sum of MgO plus CaO plus SrO plus BaO, the 10% of the range of Claim 20 is 15% of the range of the Narita reference, which range of the Narita reference is 75% of the 100% possible range of the Narita reference.

Applying the above-described probability calculation to the eight glass components, SiO₂, B₂O₃, Al₂O₃, MgO, CaO, SrO, BaO, and ZnO, the sum of SrO plus BaO, and the sum of MgO plus CaO plus SrO plus BaO, the probability that the ten ranges would encompass the ranges of Claim 20 is 0.00000207 times 0.154 which is 0.000000319 or 0.0000319% or $0.319 \times 10^{-4}\%$.

Thus, in the case of a 0.2333 chance for SiO₂, a 0.30 chance for B₂O₃, a 0.5789 chance for Al₂O₃, a 0.3 chance for MgO, a 0.6 chance for CaO, a 0.14 chance for SrO, a 0.116 chance for BaO, and a 0.20 chance for ZnO, and a 0.0875 chance for the sum of SrO plus BaO, and a 0.154 chance for the sum of MgO plus CaO plus SrO plus BaO the probability that these ten ranges would exist together in Applicants' Claim 20 on the basis of the Narita reference is only a

$0.319 \times 10^{-4}\%$ chance. That means that substantially 100% of the possible ranges of SiO_2 , B_2O_3 , Al_2O_3 , MgO , CaO , SrO , BaO , and ZnO , the sum of SrO plus BaO , and the sum of MgO plus CaO plus SrO plus BaO would lie outside of the ranges claimed for SiO_2 , B_2O_3 , Al_2O_3 , MgO , CaO , SrO , BaO , and ZnO , the sum of SrO plus BaO , and the sum of MgO plus CaO plus SrO plus BaO . In other words, the possibility that these nine ranges would be in different positions in the ranges of the Narita reference is 99.9999219 or substantially 100% and would lie outside the ranges claimed in Claim 20.

It is again submitted that the low percentage of $0.319 \times 10^{-4}\%$ is an exceedingly small percentage of the total range of possibilities as suggested in the Narita reference. The reciprocal of 0.000000319 is 3,134,796. In other words, Applicants' Claim 20 covers only $1/_{3134796}$ of the ranges as disclosed by the Narita reference for the eight components, SiO_2 , B_2O_3 , Al_2O_3 , MgO , CaO , SrO , BaO , and ZnO , the sum of SrO plus BaO , and the sum of MgO plus CaO plus SrO plus BaO .

Accordingly, the probability of a person skilled in the art choosing the ranges of Claim 20 of from more than of 58 wt% to 65 wt% for SiO_2 , of from more than 6 wt% to 10.5 wt% for B_2O_3 , of from more than 14 wt% to 25 wt% for Al_2O_3 , of from 0 wt% to less than 3 wt% for MgO , of from 0 wt% to 9 wt% for CaO , of from 0.1 wt% to 1.5 wt% for SrO , of from more than -5 wt% to 8.5 wt% for BaO , and of from 0 wt% to less than 2 wt% for ZnO , with the sum of SrO plus BaO of not more than 8.6 wt%, and with the sum of MgO plus CaO plus SrO plus BaO of from 8 wt% to 18 wt%, while being aware of the ranges of from 40 wt% to 70 wt% for SiO_2 , of from 5 wt% to 20

wt% for B_2O_3 , of from 6 wt% to 25 wt% for Al_2O_3 , of from 0 wt% to 10 wt% for MgO , of from 0 wt% to 15 wt% for CaO , of from 0 wt% to 10 wt% for SrO , of from 0 wt% to 30 wt% for BaO , and of from 0 wt% to 10 wt% for ZnO , with the sum of SrO plus BaO of 40 wt%, and with the sum of MgO plus CaO plus SrO plus BaO of 65 wt% in the Narita et al reference, is **only $0.319 \times 10^{-4}\%$** . Therefore, 99.99999681% of the possible range for SiO_2 , B_2O_3 , Al_2O_3 , MgO , CaO , SrO , BaO , and ZnO , the sum of SrO plus BaO , and the sum of MgO plus CaO plus SrO plus BaO , of the Narita reference represent the probability of being outside of the claimed ranges for SiO_2 , B_2O_3 , Al_2O_3 , MgO , CaO , SrO , BaO , and ZnO , the sum of SrO plus BaO , and the sum of MgO plus CaO plus SrO plus BaO . In contrast, Applicants' Claim 20 covers only a $1/_{3134796}$ probability of the ranges as disclosed in the Narita reference.

Thus, Applicants' Claim 20 claims an exceedingly small range, which represents a very small probability, of SiO_2 , B_2O_3 , Al_2O_3 , MgO , CaO , SrO , BaO , and ZnO , the sum of SrO plus BaO , and the sum of MgO plus CaO plus SrO plus BaO compared to these eight components, the sum of SrO plus BaO , and the sum of MgO plus CaO plus SrO plus BaO of the Narita reference. Therefore, the Narita reference does not make obvious Applicants' Claim 20 with respect to the ranges of SiO_2 , B_2O_3 , Al_2O_3 , MgO , CaO , SrO , BaO , and ZnO , and the ranges of the sum of SrO plus BaO , and the sum of MgO plus CaO plus SrO plus BaO .

Multiplication of all the ratios of Applicants' range of components vs. Narita's range of components reveals a result of 0.000000319 which corresponds to 0.0000319%.

The low percentage of 0.0000319 is an extremely small percentage of the total range of possibilities as suggested in the Narita reference. The reciprocal of 0.000000319 is 3,134,796. In other words, there are over 3,134,796 other ranges covered by the Narita reference of the same scope as the ranges of the present invention. It would be virtually impossible for someone to be able to determine which of the 3,134,796 ranges would be advantageous to cover so as to provide the invention of the present application. Still in other words, Applicants' claim covers only a $1/_{3134796}$ probability of the ranges that are covered by the Narita reference.

Thus, it is not understood how the Narita reference can make Applicants' range obvious. It is submitted that the Narita reference is not applicable as a reference because of the minuscule factor of 0.00319×10^{-4} .

It is submitted that the foregoing differences of Applicants' glass alone are sufficient to show the patentable distinction over the Narita reference.

As mentioned, there is no disclosure in the Narita reference of the sum of SrO plus BaO being at most 8.6%. There is also no disclosure in the Narita reference of the sum of MgO plus CaO plus SrO + BaO being in the range of from 8 % to 18 %. The importance of a specific BaO content in Applicants' glass will be discussed in further detail herein below.

It is clear from the foregoing comparison, that Applicants' invention is a selection invention of specific and well-defined ranges that are not obvious over the Narita reference. More specifically, Applicants' glass is claimed in terms of small ranges within the very

wide ranges of the Narita reference. The specific and well-defined ranges of Applicants' glass from within the Narita reference lead to surprising results as will be discussed in greater detail below.

Furthermore, please note, as claimed in Claim 20, Applicants' glass contains the specific range of from more than 5% to 8.5% by weight of BaO.

In Table 3 of the Narita reference, sample 1 has a BaO content of 9.5% by weight. The BaO content of 9.5% by weight is outside the claimed BaO content of from more than 5% to 8.5% by weight.

In Table 3 of the Narita reference, sample 2 has a BaO content of 24.5 % by weight. The BaO content of 24.5% by weight is outside the claimed BaO content of from more than 5% to 8.5% by weight.

In Table 3 of the Narita reference, sample 4 has a BaO content of 25.0 % by weight. The BaO content of 25% by weight is outside the claimed BaO content of from more than 5% to 8.5% by weight.

In Table 3 of the Narita reference, sample 5 has a BaO content of 12.0 % by weight. The BaO content of 12% by weight is outside the claimed BaO content of from more than 5% to 8.5% by weight.

In Table 4 of the Narita reference, sample 6 does not contain BaO. The BaO content of 0% by weight is outside the claimed BaO content of from more than 5% to 8.5% by weight.

In Table 4 of the Narita reference, sample 7 has a BaO content of 12.0 % by weight. The BaO content of 12% by weight is outside the claimed BaO content of from more than 5% to 8.5% by weight.

In Table 4 of the Narita reference, sample 8 has a BaO content of 4.0 % by weight. The BaO content of 4% by weight is outside the claimed BaO content of from more than 5% to 8.5% by weight.

In contrast to the seven samples of Tables 3 and 4 of the Narita reference discussed herein above, the glass of the present invention has a BaO content of from more than 5 % to 8.5.

Among the samples from Tables 3 and 4 of the Narita reference, in Table 4, sample 6 has a BaO content of 0% which is below the lower limit of more than 5% by weight claimed in Claim 20. In Table 4, sample 8 has a BaO content of 4.0% which is also below the lower limit of more than 5% of BaO claimed in Claim 20. The samples In Table 3, samples 1, 2, 4, and 5, and the sample in Table 4, sample 7, have a greater percentage than the upper limit of 8.5% BaO claimed in Claim 20. Thus, with respect to these seven samples, the Narita reference discloses BaO contents that are clearly **outside** of the claimed range of BaO of from more than 5% to 8.5% by weight.

Therefore, the seven samples, in Table 3 samples 1, 2, 4, and 5 of Table 3, and in Table 4 samples 6, 7, and 8 of the Narita reference discussed herein above, do not suggest and do not make obvious Applicants' glass containing a BaO content of from more than 5% to 8.5% by weight, because the BaO content disclosed in these seven samples of the Narita reference is well outside of the claimed range of BaO.

It is submitted that the glass art is an unpredictable art. Thus, any change in the composition of a glass could not predict the outcome of that glass and thus the outcome would be unpredictable. Further, what may appear to be a predictable outcome regarding glass compositions is not predictable and any appearance of predictability in this case is based on the use of hindsight, which is improper in determining obviousness.

Table 1 of the Narita reference discloses five samples, samples a, b, c, d, and e, that each have a BaO content of 6% by weight. The BaO content of 6% by weight disclosed in Table 1 for the samples a, b, c, d, and e of the Narita reference is within Applicants' claimed range of BaO of from more than 5% to 8.5% by weight. However, the Narita reference discloses an Al₂O₃ content of 16.0% by weight for the samples a, b, c, d, and e of Table 1. The Al₂O₃ content of 16 % of the Narita reference is **outside** the A₂O₃ content of from more than 18% to 24% by weight claimed in Claim 20. Furthermore, the Narita reference discloses an MgO content of 4.0% by weight for each of the samples a, b, c, d, and e of Table 1. This MgO content of 4% by weight of the Narita reference is also **outside** of the MgO content of from 0% to less than 3% by weight claimed in Claim 20.

In the five samples in Table 1, samples a, b, c, d, and e, of the Narita reference, both components, Al₂O₃ and MgO, are **outside** of the range of Applicants' Al₂O₃ and MgO content claimed in Claim 20.

It is submitted that it would be sufficient for one of the components of the claimed invention to be outside the applied art to make the claimed invention patentable.

In Table 1 five samples, samples a, b, c, d, and e, of the Narita reference both components, Al₂O₃ and MgO, are outside of the range of the content of Al₂O₃ and MgO claimed in Claim 20. Therefore, the five Table 1 samples of the Narita reference discussed herein above, do not suggest and do not make obvious Applicants' glass containing an A₂O₃ content of from more than 18% to 24% by weight, because the A₂O₃ content disclosed in the Narita reference for the five samples

is well outside of the range of Al_2O_3 content as claimed in Claim 20. Furthermore, the five Table 1 samples of the Narita reference discussed herein above, do not suggest and do not make obvious Applicants' glass containing an MgO content of from 0% to less than 3% by weight, because the MgO content disclosed in the Narita reference for the five Table 1 samples is well outside of the range of MgO content as claimed in Claim 20.

Table 2 of the Narita reference discloses six samples, samples e-1, e-2, e, e-3, e-4 and e-5, that variously have a BaO content of from 5.6% to 6.2% by weight. The BaO content disclosed in six samples of Table 2 of the Narita reference is within Applicants' range of more than 5% to 8.5% by weight of BaO . However, the Al_2O_3 content variously given as from 15.0% to 16.5 % by weight of Al_2O_3 for the six samples in Table 2, samples e-1, e-2, e, e-3, e-4 and e-5, of the Narita reference. This is **outside** of Claim 20 which claims an Al_2O_3 content of more than 18% to 24% by weight. Also, the MgO content variously given as from 3.7% to 4.1% by weight for the samples in Table 2 of the Narita reference is **outside** of Claim 20 which claims an MgO content of from 0 % to less than 3% by weight.

In the six samples of Table 2, samples e-1, e-2, e, e-3, e-4 and e-5, of the Narita reference, both components, Al_2O_3 and MgO , are **outside** of the range of Applicants' Al_2O_3 and MgO content claimed in Claim 20.

It is again submitted that it would be sufficient for one of the components of the claimed invention to be outside the applied art to make the claimed invention patentable.

In the six samples of Table 2, samples e-1, e-2, e, e-3, e-4 and

e-5, of the Narita reference, both components, Al_2O_3 and MgO , are again **outside** of the range of the claimed components. Therefore, the six samples of Table 2 of the Narita reference, discussed herein above, do not suggest and do not make obvious Applicants' glass containing an A_2O_3 content of from more than 18% to 24% by weight, because the A_2O_3 content disclosed in the Narita reference for the six samples of Table 2 is well outside of the range of A_2O_3 content as claimed in Claim 20. Furthermore, the six samples of Table 2 of the Narita reference discussed herein above, do not suggest and do not make obvious Applicants' glass containing an MgO content of from 0% to less than 3% by weight, because the MgO content disclosed in the Narita reference for the six samples of table 2 is well outside of the range of MgO content as claimed in Claim 20.

In Table 3 of the Narita reference, sample 3 has a BaO content of 6% by weight. The BaO content of 6 % by weight disclosed in Table 3 for sample 3 is within Applicants' claimed range of BaO of from more than 5% to 8.5% by weight. However, the Al_2O_3 content of 15.0% by weight disclosed in sample 3 of Table 3 of the Narita reference is **outside** of Applicants' Claim 20 which claims an Al_2O_3 content of more than 18% to 24% by weight.

It is submitted that it is sufficient for one of the components of the claimed invention to be outside the applied art to make the claimed invention patentable. In the case of sample 3 of Table 3 of the Narita reference, the Al_2O_3 content is outside of the range of the claimed components. Therefore, sample 3 of Table 3 of the Narita reference, discussed herein above, does not suggest and does not make obvious Applicants' glass containing an A_2O_3 content of from

more than 18% to 24% by weight, because the A₂O₃ content of 6.0% by weight disclosed in the Narita reference for sample 3 of Table 3 is well outside of the range of A₂O₃ content as claimed in Claim 20.

It is again submitted that the glass art is an unpredictable art. Thus, any change in the composition of a glass could not predict the outcome of that glass and thus the outcome would be unpredictable. Further, what may appear to be a predictable outcome regarding glass compositions is not predictable and any appearance of predictability in this case is based on the use of hindsight, which is improper in determining obviousness.

1d. Further Discussion Of Distinctions Of Claim 20 Over Narita et al.

The glass claimed in Claim 20 has a "coefficient of thermal expansion $\alpha_{20/300}$ of between $2.8 \times 10^{-6}/K$ and $3.8 \times 10^{-6}/K$." (emphasis added.) The glass having a BaO content of from more than 5 % to 8.5 % by weight, and the other specific ranges of the other components in Claim 20 result in a low coefficient of thermal expansion $\alpha_{20/300}$ of between $2.8 \times 10^{-6}/K$ and $3.8 \times 10^{-6}/K$, because the claimed glass composition provides for the network builders that enhance crystallization. In other words, the combination of the components claimed in Claim 20 is formulated in such a way as to produce a low coefficient of thermal expansion $\alpha_{20/300}$ of between $2.8 \times 10^{-6}/K$ and $3.8 \times 10^{-6}/K$. This permits the glass to have an expansion behavior in the same range as both, amorphous silicon and polycrystalline silicon. Therefore amorphous silicon and polycrystalline silicon can be disposed on the substrate glass as claimed in Claim 20 and the shear between silicon coated on the claimed glass substrate

and the glass substrate will be minimized. Furthermore, a low coefficient of thermal expansion as claimed in Claim 20 results in the glass having a high resistance against thermal shock and also having a high temperature strength retention, that is, the glass retains its strength upon being subjected to high temperatures.

The Narita reference, as understood, contains no indication that suggests that the glasses of the Narita reference have a low coefficient of thermal expansion of between $2.8 \times 10^{-6}/K$ and $3.8 \times 10^{-6}/K$. Therefore, the Narita reference, as understood, does not suggest or make obvious the combination of the specific composition and the specific ranges and the low coefficient of thermal expansion $\alpha_{20/300}$ of between $2.8 \times 10^{-6}/K$ and $3.8 \times 10^{-6}/K$ of Claim 20.

It is submitted that the present invention is not obvious over the Narita reference based on the foregoing.

It is also submitted that hindsight has been used to reject the claims of the present invention. However the use of hindsight is improper in determining obviousness.

Applicants' glass as claimed in Claim 20 is not obvious in view of the Narita reference further because of the following:

The glass claimed in Claim 20 has the following beneficial and surprising **properties**.

The combination of the specific claimed ranges of the glass claimed in Claim 20 provides a **high heat resistance** to minimize damage to the glass due to thermal shock on the glass. A heat resistant glass according to the "Dictionary of Ceramic Science and Engineering," by Loran S. O'Bannon, Plenum Press, New York, 1984 comprises:

"A glass of low-thermal expansion and high resistance to thermal shock such as occurs when the glass is cooled suddenly from an elevated temperature."

Discussion Of The Glass Transition Temperature:

The term glass transition temperature is defined in the German publication "ABC GLAS," Deutscher Verlag für Grundstoffindustrie, Leipzig, 1991. The translation of the term is as follows:

"Transition temperature, transition point, freezing point (formula sign T_g) - the temperature value which characterizes the region of the transformation of the glass melt from the condition of an undercooled or supercooled liquid into a quasi-solid ("frozen") condition (*transformation region, freezing region*). ..."

As understood, there is no suggestion in the Narita reference of a glass transition temperature, T_g . Further, there is no disclosure in Narita of any relationship between a glass transition temperature, T_g , on the one hand, and both, a melting temperature and a hot shaping temperature, on the other hand.

In contrast, in the present invention the glass as claimed in Claim 20, due to its specific composition and the specific ranges of the components, has a **high glass transition temperature**, T_g . A high glass transition temperature, T_g , of a glass provides a high heat resistance which is conducive to minimize damage to the glass due to thermal shock on the glass. Applicants' glass has a high glass transition temperature, T_g , of more than 700 degrees Celsius.

Even though the claimed glass has a **high glass transition temperature**, T_g , of more than 700 degrees Celsius, due to the claimed combination of glass components and the ranges of the glass components, Applicants' glass, surprisingly, also has both, a low

m Iting t mperatur and a low hot shaping temperature.

A low melting temperature is indicated by a low temperature at a viscosity of 10^2 dPas. The present application discloses a temperature of at most 1350 degrees Celsius at a viscosity of 10^2 dPas.

A low hot shaping or hot forming temperature, also referred to as processing temperature V_A , is indicated by a low temperature at a viscosity of 10^4 dPas. The present application discloses a temperature at a viscosity of 10^4 dPas of at most 1350 degrees Celsius.

It is surprising that Applicants' glass has a **high** glass transition temperature, T_g , and also has both, a **low** melting temperature, at a viscosity of 10^2 dPas of at most 1720 degrees Celsius, and a **low** hot shaping temperature, at a viscosity of 10^4 dPas of at most 1350 degrees Celsius.

It is submitted that a person skilled in the art would not expect this relationship and would expect the opposite to be true: That is, that a high glass transition temperature, T_g , of more than 700 degrees Celsius would result in both, a high melting temperature, at a viscosity of 10^2 dPas of more than 1720 degrees Celsius, and a high hot shaping temperature, of processing temperature, V_A , at a viscosity of 10^4 dPas of more than 1350 degrees Celsius..

It may be added that most of the glasses of the Narita reference, especially those with a relatively high strain point, contain a low percentage of BaO. A low percentage of BaO means that the crystallization stability of the glasses according to Narita reference will not be sufficient to permit use of the glass in various flat glass production processes, such as, float methods and the various drawing

methods.

As claimed, the specific BaO content of from more than 5 % to 8.5 % by weight and the other specific ranges of the other components of the glass permit a sufficient degree of crystallization stability of the glass of Claim 20. The crystallization stability permits use of the glass in various flat glass production processes, such as, float methods and the various drawing methods.

It is clear from the foregoing that the Narita reference does not make obvious Applicants' claim 20 and thus Applicants' Claim 20 should be allowed.

1e. Discussion Of Dependent Claims 42-51 Dependent Upon Claim 20

It is submitted that the dependent Claims 42-51 are allowable based on their dependence from Claim 20. Claim 20 has been discussed in detail above. Since the combination of the limitations of Claim 20 is not shown or disclosed in the Narita reference, it is submitted that Claims 42-51 are not made obvious, and Claims 42-51 should be allowed.

1f. Discussion Of Rejection Of Examined Claim 17 In View Of Narita

With reference to the Abstract, the cited Narita reference discloses:

"an alkali-free glass consisting of
40-70 wt% SiO₂,
5-20 wt% B₂O₃,
6-25 wt% Al₂O₃,
0-10 wt% MgO,
0-15 wt% CaO,
0-10 wt% SrO,
0-30 wt% BaO,

0-10 wt% ZnO,
0.05-2 wt% SnO₂, and
0.005-2 wt% Cl₂." (emphasis added)

It is again submitted that the Narita reference discloses substantial ranges for the components of the glass in accordance with the Narita reference. For example, the Abstract of the Narita reference discloses a BaO content that is to be within the wide range of from 0 wt% to 30 wt% of BaO. This is a substantial range of BaO content that does not make obvious Applicants' range of BaO content.

In contrast to the Narita reference, Claim 17 states:

"17. A glass substrate for a flat panel liquid-crystal display, such as for a laptop computer, the flat panel liquid-crystal display including a twisted nematic display, a supertwisted nematic display, an active matrix liquid-crystal display, a thin film transistor display, and a plasma addressed liquid-crystal display, said substrate comprising:

an alkali-free aluminoborosilicate glass;

said glass having a coefficient of thermal expansion $\alpha_{20/300}$ of between $2.8 \times 10^{-6}/K$ and $3.8 \times 10^{-6}/K$;

said glass having the composition (in % by weight, based on oxide):

SiO₂ > 58 - 64.5

B₂O₃ > 6 - 10.5

Al₂O₃ > 18 - 24

MgO 0 - < 3

CaO 1 - < 8

SrO 0.1 - 1.5

BaO > 5 - 8

with SrO + BaO - < 8.5

with MgO + CaO + SrO + BaO 8 - 18

ZnO 0 - < 2;

said glass being configured to be resistant to thermal shock;

said glass being configured to have a high transparency over a broad spectral range in the visible and ultra violet ranges; and

said glass being configured to be free of bubbles, knots, inclusions, streaks, and surface undulations." (emphasis added)

It is submitted that the presentation made for Claim 20 above, applies correspondingly to Claim 17 because Claim 17 claims narrower ranges of the glass components than Claim 20.

Therefore, it is submitted that Claim 17 and the Claims 34-41 dependent therefrom are not obvious over the Narita reference and Claims 17 and 34-41 should be allowed.

1g. Discussion Of Dependent Claims 34-41 Dependent Upon Claim 17

It is submitted that the dependent Claims 34-41 are allowable based on their dependence upon Claim 17, having regard to the presentation made for Claim 17. Since the combination of the limitations of Claim 17 is not shown or disclosed in the Narita reference, it is submitted that Claims 34-41, dependent upon Claim 17, are not made obvious, and Claims 34-41 should be allowed.

2. Rejection Of Claims 17-29 Under 35 U.S.C. §103 In View Of Peuchert

Claims 17-29 were rejected under 35 U.S.C. 103(a) as being unpatentable over Peuchert et al. (US 6,417,124).

2a. Rejection Of Examined Claim 20 In View of Peuchert

The Examiner stated:

"Claims 17-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Peuchert et al., U.S. 6,417,124.

Peuchert et al. teach an alkali-free aluminoborosilicate comprising 50-70 wt% SiO₂, 0.5-15 wt% B₂O₃, 10-25 wt% Al₂O₃, 0-10 wt% MgO, 0-10 wt% CaO, 0-12 wt% SrO, 0-15 wt% BaO, 0-10 wt% ZnO, 0-5 wt% ZrO₂, 0-5 wt% TiO₂, 0-2 SnO₂, and 0.05-2 MoO₃. See abstract of Peuchert et al. The reference teaches that the glass can be used as a substrate for thin film

transistors, active matrix liquid crystal displays, and plasma addressed liquid crystals. See column 1, lines 6-11. The reference teaches that glasses for the above applications have high thermal shock resistance, high transparency over a broad spectral range (UV and VIS), and a density equal to or lower than 2.6 g/cm³. See column 1, lines 11-16. The reference teaches that the glasses can be produced by the float glass method, which produces streak-free substrates with low surface undulations. See column 1, lines 25-30. The reference teaches that the glasses are free from As₂O₃ and Sb₂O₃. See column 5, lines 41-49. The reference teaches that the T_g is greater than 650°C. See column 7, line 46. The reference further teaches that the thermal expansion coefficient is from 2.8x10⁻⁶/K to 5.0x10⁻⁶/K. See column 8, lines 43-44.

Peuchert et al. differ from the instant claims by not teaching specific examples that lie within the compositional ranges nor ranges of glass components which are sufficiently specific to anticipate the claim limitations. However, the compositional ranges of Peuchert et al. overlap the compositional ranges of claims 17-29. Overlapping ranges have been held to establish prima facie obviousness. See MPEP 2144.05.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected from the overlapping portion of the ranges of Peuchert et al. because overlapping ranges have been held to establish prima facie obviousness."

2b. Discussion Of Rejection Of Examined Claim 20 In View Of Peuchert

With reference to the Abstract, the cited Peuchert reference discloses:

"an alkali-free aluminoborosilicate comprising
50-70 wt% SiO₂,
0.5-15 wt% B₂O₃,
10-25 wt% Al₂O₃,
0-10 wt% MgO,
0-10 wt% CaO,
0-12 wt% SrO,
0-15 wt% BaO,

0-10 wt% ZnO,
0-5 wt% ZrO₂,
0-5 wt% TiO₂,
0-2 SnO₂, and
0.05-2 MoO₃."

It is submitted that the Peuchert reference discloses very large ranges for eight of the components of the aluminoborosilicate glass, namely, 50-70 wt% for SiO₂, 0.5-15 wt% for B₂O₃, 10-25 wt% for Al₂O₃, 0-10 wt% for MgO, 0-10 wt% for CaO, 0-12 wt% for SrO, 0-15 wt% for BaO, and 0-10 wt% for ZnO.

It is submitted that the large ranges for the mentioned eight glass components of the Peuchert reference cover a great number of different types of borosilicate glass.

Applicants' Claim 20 states:

"A glass comprising:
a substantially alkali-free aluminoborosilicate glass;
said glass having a coefficient of thermal expansion $\alpha_{20/300}$ of between $2.8 \times 10^{-6}/K$ and $3.8 \times 10^{-6}/K$;
said glass having the composition (in % by weight, based on oxide):

SiO ₂	> 58 - 65
B ₂ O ₃	> 6 - 10.5
Al ₂ O ₃	> 14 - 25
MgO	0 - < 3
CaO	0 - 9
SrO	0.1 - 1.5
BaO	> 5 - 8.5
with SrO + BaO	≤ 8.6
with MgO + CaO + SrO + BaO	8 - 18
ZnO	0 - < 2."

It is submitted that Applicants' Claim 20 claims a **selection invention** of a selection of specific ranges for the specific components of the claimed glass. The ranges of the present

invention include only a portion of the ranges of the Peuchert reference. Therefore, the Peuchert reference is a non-teaching. The specific characteristics of the present invention result only by selecting the very specific ranges of the specific components. Since there is nothing in the Peuchert reference that would point to the specific ranges of the specific components of the present invention, it is further submitted that Applicants' selection invention is not obvious over the Peuchert reference.

In the following, the distinctions between the glass of the Peuchert reference and the glass of Applicants' Claim 20 are summarized in Table 2 on the following page. It is submitted that the detailed analysis presented with respect to Claim 20 in connection with the Narita reference, above, applies in corresponding manner in the presentation in connection with the Peuchert reference.

Table 2 - Comparison Of Glass Of Peuchert et al.
 And Glass Of Applicants' Claim 20

Component or Sum of Components	Peuchert's Ranges of Components	Overlap between Applicants' Ranges of Components and Peuchert's Ranges of Components	Ratio of Applicants' Ranges of Components to Peuchert's Ranges of Components	Running Probability
SiO_2	20%	7%	0.35	1 in 9
B_2O_3	14.5%	4.5%	0.31	1 in 12
Al_2O_3	15%	11%	0.73	1 in 42
MgO	10%	3%	0.30	1 in 56
CaO	12%	9%	0.75	1 in 483
SrO	12%	1.4%	0.116	1 in 2,103
BaO	15%	3.5%	0.23	1 in 10,515
ZnO	10%	2%	0.20	1 in 78,127
$\text{SrO} + \text{BaO}$	26%	3.5%	0.135	1 in 140,770
$\text{MgO} + \text{CaO} + \text{SrO} + \text{BaO}$	18%	10%	0.555	

Multiplication of all the ratios of Applicants' range of components vs. Peuchert's range of components reveals a result of 0.0000071 which corresponds to 0.00071%.

The low percentage of 0.00071 is an extremely small percentage of the total range of possibilities as suggested in the Peuchert reference. The reciprocal of 0.0000071 is 140,770. In other words, there are over 140,770 other ranges covered by the Peuchert reference of the same scope as the ranges of the present invention. It would be virtually impossible for someone to be able to determine which of the 140,770 ranges would be advantageous to cover so as to provide the invention of the present application. Still in other words, Applicants' claim covers only a $1/_{140770}$ probability of the ranges that are covered by the Peuchert reference.

Thus, it is not understood how the Peuchert reference can make Applicants' ranges obvious. It is submitted that the Peuchert reference is not applicable as a reference because of the minuscule factor of 0.071×10^{-4} .

It is submitted that the foregoing differences of Applicants' glass are sufficient to show the patentable distinction over the Peuchert reference.

Furthermore, there is no disclosure in the Peuchert reference that the sum of SrO plus BaO is to be at most 8.6%. The importance of a specific BaO content in Applicants' glass has been discussed in Section 1d., above.

It is clear from the foregoing that the Peuchert reference does not make obvious Applicants' Claim 20 and thus Applicants' Claim 20 should be allowed.

2c. Discussion Of Dependent Claims 42-51 Dependent Upon

Claim 20

It is submitted that the dependent Claims 42-51 are allowable based on their dependence upon Claim 20, having regard to the presentation made for Claim 20. Since the combination of the limitations of Claim 20 is not shown or disclosed in the Peuchert reference, it is submitted that Claims 42-51, dependent upon Claim 20, are not made obvious, and Claims 42-51 should be allowed.

2d. Rejection of Examined Claim 17 And Claims 34-41 In View of Peuchert

With reference to the Abstract, the cited Peuchert reference discloses:

"an alkali-free aluminoborosilicate comprising 50-70 wt% SiO₂, 0.5-15 wt% B₂O₃, 10-25 wt% Al₂O₃, 0-10 wt% MgO, 0-10 wt% CaO, 0-12 wt% SrO, 0-15 wt% BaO, 0-10 wt% ZnO, 0-5 wt% ZrO₂, 0-5 wt% TiO₂, 0-2 SnO₂, and 0.05-2 MoO₃."

It is submitted that the Peuchert reference discloses very large ranges for eight of the components of the aluminoborosilicate glass, namely, .50-70 wt% for SiO₂, 0.5-15 wt% for B₂O₃, 10-25 wt% for Al₂O₃, 0-10 wt% for MgO, 0-10 wt% for CaO, 0-12 wt% for SrO, 0-15 wt% for BaO, and 0-10 wt% for ZnO.

It is submitted that the very large ranges for the mentioned eight

glass components of the Peuchert reference cover a great number of different types of borosilicate glass.

In contrast to the Peuchert reference, Claim 17 states:

"17. A glass substrate for a flat panel liquid-crystal display, such as for a laptop computer, the flat panel liquid-crystal display including a twisted nematic display, a supertwisted nematic display, an active matrix liquid-crystal display, a thin film transistor display, and a plasma addressed liquid-crystal display, said substrate comprising:

an alkali-free aluminoborosilicate glass;

said glass having a coefficient of thermal expansion $\alpha_{20/300}$ of between $2.8 \times 10^{-6}/K$ and $3.8 \times 10^{-6}/K$;

said glass having the composition (in % by weight, based on oxide):

SiO_2 > 58 - 64.5

B_2O_3 > 6 - 10.5

Al_2O_3 > 18 - 24

MgO 0 - < 3

CaO 1 - < 8

SrO 0.1 - 1.5

BaO > 5 - 8

with $\text{SrO} + \text{BaO}$ < 8.5

with $\text{MgO} + \text{CaO} + \text{SrO} + \text{BaO}$ 8 - 18

ZnO 0 - < 2;

said glass being configured to be resistant to thermal shock;

said glass being configured to have a high transparency over a broad spectral range in the visible and ultra violet ranges; and

said glass being configured to be free of bubbles, knots, inclusions, streaks, and surface undulations."

--It is submitted that the presentation made for Claim 20 above, applies correspondingly to Claim 17 because Claim 17 claims narrower ranges of the glass components than Claim 20.

Therefore, it is submitted that Claim 17 and the Claims 34-41 dependent therefrom are not obvious over the Peuchert reference and

Claims 17 and 34-41 should be allowed.

3. Rejection Of Claims 17-29 Under 35 U.S.C. §103 In View Of Watzke

Claims 17-29 were rejected under 35 U.S.C. 103(a) as being unpatentable over Watzke (German DOS 196 01 922 A1).

3a. Rejection Of Examined Claim 20 In View Of Watzke

Specifically, the Examiner stated:

"Claims 17-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watzke, German Patent DE 19601922 A1.

Watzke teaches an alkaline earth aluminoborosilicate glass consisting of 50-65 wt% SiO₂, 5-15 wt% B₂O₃, 10-20 wt% Al₂O₃, 0-10 wt% MgO, 0-20 wt% CaO, 0-20 wt% SrO, 0-20 wt% BaO, 0-10 wt% ZnO, 0.01-1 wt% SnO, 0.1-2 wt% ZrO₂, 0-10 La₂O₃, 0-10 wt% Nb₂O₅, 0-10 wt% Ta₂O₅ and 0-10 wt% TiO₂. See the Derwent Abstract of Watzke.

More specifically, Watzke teaches the compositional ranges are 53-63 wt% SiO₂, 5-15 wt% B₂O₃, 12-20 Al₂O₃, 0-5 wt% MgO, 2-10 wt% CaO, 0-10 wt% SrO, 3-15 wt% BaO, 0.01-1 wt% SnO, and 0.1-1 wt% ZrO₂. See page 3, lines 37-38 of DE 19,601,922. Watzke teaches that glass can be used as a substrate for display technologies or as thin layer solar cells. See the Derwent Abstract, use paragraph.

Watzke differs from the instant claims by not teaching specific examples that lie within the compositional ranges nor ranges of glass components which are sufficiently specific to anticipate the claim limitations. However, the compositional ranges of Watzke overlap the compositional ranges of claims 17-29. Overlapping ranges have been held to establish prima facie obviousness. See MPEP 2144.05.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected from the overlapping portion of the ranges of Watzke because overlapping ranges have been held to establish prima facie obviousness.

One of ordinary skill in the art would expect that glasses

with overlapping compositional ranges would have overlapping ranges of properties as recited in claims 17-21, 28, and 29."

3b. Discussion Of Rejection Of Examined Claim 20 In View Of Watzke

With reference to the DERWENT Abstract, Watzke discloses:

"alkaline earth aluminoborosilicate glass consisting of 50-65 wt% SiO₂, 5-15 wt% B₂O₃, 10-20 wt% Al₂O₃, 0-10 wt% MgO, 0-20 wt% CaO, 0-20 wt% SrO, 0-20 wt% BaO, 0-10 wt% ZnO, 0.01-1 wt% SnO, 0.1-2 wt% ZrO₂, 0-10 La₂O₃, 0-10 wt% Nb₂O₅, 0-10 wt% Ta₂O₅ and 0-10 wt% TiO₂."

It is submitted that the Watzke reference discloses very large ranges for at least four of the components of the aluminoborosilicate glass, namely, 0-10 wt% for MgO, 0-20 wt% for CaO, 0-20 wt% for SrO, and 0-20 wt% for BaO.

It is submitted that the large ranges for the mentioned four glass components of the Watzke reference cover a great number of different types of borosilicate glass.

With reference to the example on page 3, lines 37-38, Watzke discloses:

"alkaline earth aluminoborosilicate glass consisting of 53-63 wt% SiO₂, 5-15 wt% B₂O₃, 12-20 wt% Al₂O₃, 0-5 wt% MgO,

2-10 wt% CaO,
0-10 wt% SrO, and
3-15 wt% BaO."

It is submitted that the Watzke reference discloses very large ranges for at least four of the components of the aluminoborosilicate glass, namely, 0-5 wt% for MgO, 2-10 wt% for CaO, 0-10 wt% for SrO, and 3-15 wt% for BaO.

It is submitted that the large ranges for the mentioned four glass components of the Watzke reference cover a great number of different types of borosilicate glass.

Applicants' Claim 20 states:

"A glass comprising:
a substantially alkali-free aluminoborosilicate glass;
said glass having a coefficient of thermal expansion $\alpha_{20/300}$ of between $2.8 \times 10^{-6}/K$ and $3.8 \times 10^{-6}/K$;
said glass having the composition (in % by weight, based on oxide):

SiO ₂	> 58 - 65
B ₂ O ₃	> 6 - 10.5
Al ₂ O ₃	> 14 - 25
MgO	0 - < 3
CaO	0 - 9
SrO	0.1 - 1.5
BaO	> 5 - 8.5
with SrO + BaO	≤ 8.6
with MgO + CaO + SrO + BaO	8 - 18
ZnO	0 - < 2."

It is submitted that Applicants' Claim 20 claims a **selection invention** of a selection of specific ranges for the specific components of the claimed glass. The ranges of the present invention include only a portion of the ranges of the Watzke

reference. Therefore, the Watzke reference is a non-teaching. The specific characteristics of the present invention result only by selecting the very specific ranges of the specific components. Since there is nothing in the Watzke reference that would point to the specific ranges of the specific components of the present invention, it is further submitted that Applicants' selection invention is not obvious over the Watzke reference.

In the following, the distinctions between the glass of the Watzke according to the DERWENT Abstract and the example on page 3, lines 37-38 of Watzke, and the glass of Applicants' Claim 20 are summarized in Tables 3 and 4. It is submitted that the detailed analysis presented with respect to Claim 20 in connection with the Narita reference applies in corresponding manner for the presentation in connection with the Watzke reference.

Please note that Watzke presents some ranges that overlap with the ranges of Claim 20. For example, in the abstract of Watzke the Al₂O₃ content is 10-20%, and in the page 3 example of Watzke the Al₂O₃ content is 12-20%. In Claim 20, the Al₂O₃ is 14-25%. The overlap between the Al₂O₃ range of Watzke, either in the abstract or on page 3, and the Al₂O₃ range of Claim 20 is therefore 14-20%, for a range of 6%. This formula was used to calculate the results shown in the subsequent Tables 3 and 4.

Table 3 - Comparison Of Glass Of Watzke (Ranges in Abstract)
 And Glass Of Applicants' Claim 20

Component or Sum of Components	Watzke's Ranges of Components	Overlap between Applicants' Ranges of Components and Watzke's Ranges of Components	Ratio of Applicants' Ranges of Components to Watzke's Ranges of Components	Running Probability
SiO ₂	15%	7%	0.466	
B ₂ O ₃	10%	4.5%	0.45	1 in 5
Al ₂ O ₃	10%	6%	0.60	1 in 8
MgO	10%	3%	0.30	1 in 26
CaO	20%	9%	0.45	1 in 59
SrO	20%	1.4%	0.07	1 in 841
BaO	20%	3.5%	0.175	1 in 4,806
ZnO	10%	2%	0.20	1 in 24,030
SrO + BaO	40%	3.5%	0.0875	1 in 274,626
MgO + CaO + SrO + BaO	70%	10%	0.143	1 in 1,920,465

Table 4 - Comparison Of Glass Of Watzke (Ranges on Page 3, lines 37-38)
 And Glass Of Applicants' Claims 20 and 42

Component or Sum of Components	Watzke's Ranges of Components	Overlap between Applicants' Ranges of Components and Watzke's Ranges of Components	Ratio of Applicants' Ranges of Components to Watzke's Ranges of Components	Running Probability
SiO ₂	10%	5%	0.5	
B ₂ O ₃	10%	4.5%	0.45	1 in 4
Al ₂ O ₃	8%	6%	0.75	1 in 6
MgO	5%	3%	0.6	1 in 10
CaO	8%	7%	0.875	1 in 11
SrO	10%	1.4%	0.14	1 in 81
BaO	12%	3.5%	0.292	1 in 276
SrO + BaO	22%	3.5%	0.159	1 in 1,739
MgO + CaO + SrO + BaO	35%	10%	0.286	1 in 6,097
ZnO (Claim 42 only)	10%	1.9%	0.19	1 in 32,154

With respect to Table 3, multiplication of all the ratios of Applicants' range of components vs. Watzke's Abstract range of components reveals a result of 0.0000005207 which corresponds to 0.00005207%.

The low percentage of 0.00005207 is an extremely small percentage of the total range of possibilities as suggested in the Watzke Abstract. The reciprocal of 0.0000005207 is 497,898. In other words, there are over 497,898 other ranges covered by the Watzke Abstract of the same scope as the ranges of the present invention. It would be virtually impossible for someone to be able to determine which of the 497,898 ranges would be advantageous to cover so as to provide the invention of the present application. Still in other words, Applicants' claim covers only a $1/_{497898}$ probability of the ranges that are covered by the Watzke Abstract.

Thus, it is not understood how the Watzke reference can make Applicants' ranges obvious. It is submitted that the Watzke reference is not applicable as a reference because of the minuscule factor of $0.00005207 \times 10^{-4}$.

With respect to Table 4, multiplication of all the ratios of Applicants' range of components vs. Watzke's range of components on page 3, lines 37-38, reveals a result of 0.0000311 which corresponds to 0.00311%.

The low percentage of 0.00311 is a small percentage of the total range of possibilities as suggested in page 3, lines 37-38, of Watzke.

Thus, it is not understood how the Watzke reference can make Applicants' ranges obvious.

In addition, Claim 42, which depends directly from Claim 20,

sets forth a minimum amount of ZnO of at least 0.1 wt%, thus defining a range for ZnO of at least 0.1% to less than 2%. In the example on page 3, lines 37-38, of Watzke, ZnO is not listed as one of the components, and thus it is believed that Claim 42 distinguishes over this example. However, Watzke does disclose ZnO in the range of 0-10% in the abstract. Assuming some amount of ZnO in the range of 0-10% could be added to the example on page 3, lines 37-38, it is respectfully submitted that the probability of someone determining the range of ZnO, as set forth in Claim 42, in addition to all of the other component ranges as discussed above, is 1 in 32,154 (see Table 4), which again would appear to be highly unlikely to virtually impossible.

Furthermore, there is no disclosure in the Watzke reference of the sum of SrO plus BaO being at most 8.6%. There is also no disclosure in the Watzke reference of the sum of MgO plus CaO plus SrO plus BaO being in the range of from 8 % to 18 %. The importance of a specific BaO content in Applicants' glass has been discussed in Section 1d., above.

It is clear from the foregoing that the Watzke reference does not make obvious Applicants' Claim 20 and thus Applicants' Claim 20 should be allowed.

3c. Discussion Of Dependent Claims 42-51 Dependent Upon Claim 20

It is submitted that the dependent Claims 42-51 are allowable based on their dependence upon Claim 20, having regard to the presentation made for Claim 20. Since the combination of the limitations of Claim 20 is not shown or disclosed in the Watzke

reference, it is submitted that Claims 42-51, dependent upon Claim 20, are not made obvious, and Claims 42-51 should be allowed.

3d. Rejection Of Examined Claim 17 And Claims 34-41 In View Of Watzke

With reference to the DERWENT Abstract, Watzke discloses:

"alkaline earth aluminoborosilicate glass consisting of 50-65 wt% SiO₂, 5-15 wt% B₂O₃, 10-20 wt% Al₂O₃, 0-10 wt% MgO, 0-20 wt% CaO, 0-20 wt% SrO, 0-20 wt% BaO, 0-10 wt% ZnO, 0.01-1 wt% SnO, 0.1-2 wt% ZrO₂, 0-10 La₂O₃, 0-10 wt% Nb₂O₅, 0-10 wt% Ta₂O₅ and 0-10 wt% TiO₂."

It is submitted that the Watzke reference discloses very large ranges for at least four of the components of the aluminoborosilicate glass, namely, 0-10 wt% for MgO, 0-20 wt% for CaO, 0-20 wt% for SrO, and 0-20 wt% for BaO.

It is submitted that at least the large ranges for the mentioned four glass components of the Watzke reference cover a great number of different types of borosilicate glass.

In contrast to the Watzke reference, Claim 17 states:

"17. A glass substrate for a flat panel liquid-crystal display, such as for a laptop computer, the flat panel liquid-crystal display including a twisted nematic display, a supertwisted nematic display, an active matrix liquid-crystal display, a thin film transistor display, and a plasma addressed

liquid-crystal display, said substrate comprising:
an alkali-free aluminoborosilicate glass;
said glass having a coefficient of thermal expansion $\alpha_{20/300}$ of between $2.8 \times 10^{-6}/K$ and $3.8 \times 10^{-6}/K$;
said glass having the composition (in % by weight, based on oxide):

SiO ₂	> 58 - 64.5
B ₂ O ₃	> 6 - 10.5
Al ₂ O ₃	> 18 - 24
MgO	0 - < 3
CaO	1 - < 8
SrO	0.1 - 1.5
BaO	> 5 - 8
with SrO + BaO	< 8.5
with MgO + CaO + SrO + BaO	8 - 18
ZnO	0 - < 2;

said glass being configured to be resistant to thermal shock;
said glass being configured to have a high transparency over a broad spectral range in the visible and ultra violet ranges; and
said glass being configured to be free of bubbles, knots, inclusions, streaks, and surface undulations."

It is submitted that the presentation made for Claim 20 above, applies correspondingly to Claim 17 because Claim 17 claims narrower ranges of the glass components than Claim 20.

Therefore, it is submitted that Claim 17 and the Claims 34-41 dependent therefrom are not obvious over the Watzke reference and Claims 17 and 34-41 should be allowed.

4. Rejection Of Claims 17-29 Under 35 U.S.C. § 103 In View Of Lautenschläger

Claims 17-29 were rejected under 35 U.S.C. 103(a) as being unpatentable over Lautenschläger et al. (US 6,465,381), Lautenschläger herein.

4a. Rejection Of Examined Claim 20 In View Of Lautenschläger

The Examiner stated:

"Lautenschläger et al. teach an alkali-free glass consisting of >60-65 wt% SiO₂, 6.5-9.5 wt% B₂O₃, 14-21 wt% Al₂O₃, 1-8 wt% MgO, 1-6 wt% CaO, 1-9 wt% SrO, 0.1-3.5 wt% BaO, 0.1-1.5 wt% ZrO₂, 0.1-1 wt% SnO₂, 0.1-1 TiO₂ and 0.001-1 wt% CeO₂. See abstract of Lautenschläger et al. Lautenschläger et al. teach that glass can be used as a substrate for display technologies. See Abstract of Lautenschläger et al. The reference teaches that the glasses used for display technologies have the following properties: coefficient of thermal expansion from 3.0 to 3.8x10⁻⁶/K, T_g from 710-780 °C, a density less than or equal to 2.5 g/cm³, and free from visual defects such as inclusions, knots, and bubbles. See column 1, lines 35-67. Lautenschläger et al. teach that the glass can be produced with the above mentioned properties by the float glass or draw methods. See column 4, lines 41-52. The reference further teaches that As₂O₃ and Sb₂O₃ should not be contained in glasses produced in the float method but may be used in nonreducing conditions such as downdraw method. See column 7, lines 25-36.

Lautenschläger et al. differ from the instant claims by not teaching specific examples that lie within the compositional ranges nor ranges of glass components which are sufficiently specific to anticipate the claim limitations. However, the compositional ranges of Lautenschläger et al. overlap the compositional ranges of claims 17-29. Overlapping ranges have been held to establish prima facie obviousness. See MPEP 2144.05.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected from the overlapping portion of the ranges of Lautenschläger et al. because overlapping ranges have been held to establish prima facie obviousness."

4b. Discussion Of Rejection Of Examined Claim 20 In View Of Lautenschläger

With reference to the Abstract, Lautenschläger discloses:

"alkali-free glass consisting of

>60-65 wt% SiO₂,
6.5-9.5 wt% B₂O₃,
14-21 wt% Al₂O₃,
1-8 wt% MgO,
1-6 wt% CaO,
1-9 wt% SrO,
0.1-3.5 wt% BaO,
0.1-1.5 wt% ZrO₂,
0.1-1 wt% SnO₂,
0.1-1 TiO₂ and
0.001-1 wt% CeO₂." (emphasis added)

In the abstract of Lautenschläger, the BaO content is listed in the range of 0.1 - 3.5 wt%. Lautenschläger does not show the BaO content higher than 3.5 wt%.

It is also submitted that Lautenschläger only refers to glasses that contain ZrO₂, SnO₂, TiO₂, and CeO₂. The glasses have to contain all four alkaline earth metal oxides which is not a requirement in the claimed invention.

With respect to the SrO content of Lautenschläger, all examples show \geq 4 wt-%, which is too high for the important melting and hot forming properties, as discussed in detail above.

In contrast, Applicants' Claim 20 states:

"A glass comprising:
a substantially alkali-free aluminoborosilicate glass;
said glass having a coefficient of thermal expansion $\alpha_{20/300}$
of between $2.8 \times 10^{-6}/K$ and
 $3.8 \times 10^{-6}/K$;
said glass having the composition (in % by weight, based
on oxide):

SiO ₂	> 58 - 65
B ₂ O ₃	> 6 - 10.5
Al ₂ O ₃	> 14 - 25
MgO	0 - < 3
CaO	0 - 9

SrO	0.1 - 1.5
BaO	> 5 - 8.5
with SrO + BaO	≤ 8.6
with MgO + CaO + SrO + BaO	8 - 18
ZnO	0 - < 2."

It is respectfully submitted that, in contrast to Lautenschläger, the BaO content is listed in the range of greater than 5 to 8.5 wt% in Claim 20. Lautenschläger does not show the BaO content higher than 3.5 wt%.

It is submitted that Applicants' Claim 20 claims a **selection invention** of a selection of specific ranges for the specific components of the claimed glass. The specific characteristics of the present invention result only by selecting the very specific ranges of the specific components. Since there is nothing in the Lautenschläger reference that would point to the specific ranges of the specific components of the present invention, it is further submitted that Applicants' selection invention is not obvious over the Lautenschläger reference.

It is clear from the foregoing that the Lautenschläger reference does not make obvious Applicants' Claim 20 and thus Applicants' Claim 20 should be allowed.

4c. Discussion Of Dependent Claims 42-51 Dependent Upon Claim 20

It is submitted that the dependent Claims 42-51 are allowable based on their dependence upon Claim 20, having regard to the presentation made for Claim 20. Since the combination of the limitations of Claim 20 is not shown or disclosed in the Lautenschläger reference, it is submitted that Claims 42-51, dependent

upon Claim 20, are not made obvious by Lautenschläger, and Claims 42-51 should be allowed.

4d. Rejection Of Examined Claim 17 And Claims 34-41 In View Of Lautenschläger

It is submitted that the presentation made for Claim 20 above, applies correspondingly to Claim 17 because Claim 17 claims narrower ranges of the glass components than Claim 20.

Therefore, it is submitted that Claim 17 and the Claims 34-41 dependent therefrom are not obvious over the Lautenschläger reference and Claims 17 and 34-41 should be allowed.

Art Made of Record

The prior art made of record and not applied has been carefully reviewed, and it is submitted that it does not, either taken singly or in any reasonable combination with the other prior art of record, defeat the patentability of the present invention or render the present invention obvious. Further, Applicants are in agreement with the Examiner that the prior art made of record and not applied does not appear to be material to the patentability of the claims currently pending in this application.

In view of the above, it is respectfully submitted that this application is in condition for allowance, and early action towards that end is respectfully requested.

Leave to Delay Treatment of Formal Objections Until Allowable Subject Matter is Indicated

In accordance with 37 C.F.R. §1.111, it is hereby respectfully requested that any objections or requirements not fully treated and set forth in the outstanding Office action that relate to form and are not

necessary to further consideration of the now pending claims, be held in abeyance until allowable subject matter is indicated.

Summary and Conclusion

It is submitted that Applicants have provided a new and unique FLAT PANEL LIQUID-CRYSTAL DISPLAY SUCH AS FOR A LAPTOP COMPUTER. It is submitted that the claims, as amended, are fully distinguishable from the prior art. Therefore, it is requested that a Notice of Allowance be issued at an early date.

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Respectfully submitted,



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